

# EXHIBIT 22

CONFIDENTIAL



# QUOTATION

DATE  
9/19/2013

QUOTATION NUMBER  
131909W3267

1 Mustang Drive Cohoes NY, 12047  
Tel 516 371 2684 ext 2421  
Fax 516 371 2686  
JConnelly@pva.net  
www.pva.net

TO:  
Duc Q. Phan  
SpaceX  
1 Rocket Road  
Hawthorne, CA 90250

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QTY	MODEL	DESCRIPTION	Price/ea	Extended
1	B72-01433	Rework the dispense system on machine serial number W3267 to connect one cartridge to (1) one gallon tank for automatic solvent flush of Arethane 5705. <ul style="list-style-type: none"> <li>Includes all hoses and fittings needed for complete integration.</li> <li>Includes one pneumatic ball valve for automatic solvent flush.</li> <li>Includes hardware and software needed for integration.</li> <li>Includes new one gallon tank.</li> </ul>	\$4,175.00	\$4,175.00
1	ON-SITE	On-site from PVA to travel to Space X and install the new auto solvent flush system <ul style="list-style-type: none"> <li>Labor rate based on 8-10 hour work day Monday through Friday non-JS holiday.</li> </ul>	\$1,150.00	\$1,150.00
1	Expenses	Estimate of the direct travel expenses to travel from Cohoes NY to Hawthorne CA for one full day on-site <ul style="list-style-type: none"> <li>Expenses to include but not limited to airfare, lodging, ground transportation and meals.</li> <li>Estimate can be used as a not to exceed limit.</li> </ul>	\$1,750.00	\$1,750.00

Total: \$7,075.00

TERMS	DELIVERY	SHIPMENT	WARRANTY
100% Net 30	6 weeks ARO	FOB PVA Factory Cohoes NY USA, + crating charge of up to \$500 (if applicable)	1 Year on all parts and labor Excluding soft seals.

## ORDER CANCELLATION POLICY

Buyer may only cancel the order for equipment in writing with a cancel charge as per the following schedule:

Cancellation Notice Received  
0-30 days from order date  
31-60 days from order date  
More than 60 days from order date

Cancellation Fee Multiplier  
25%  
35%  
70%



## PURCHASE ORDER

Page 1 of 2

APPROVED

## Bill To:

Space Exploration Technologies  
1 Rocket Road  
Hawthorne, CA 90250  
Phone: (310)363-6000 Fax: (310)363-6001

## PO Number:

258364

## Revision Number:

0

## Order Date:

9/24/2013

## Issued To:

PVA - Precision Valve & Automation, Inc  
1 Mustang Dr  
Cohoes, NY 12047 US  
Phone: 518.371.2684 Fax 518.371.2688  
Contact:  
Email:

## Ship To:

Space Exploration Technologies  
1 Rocket Road  
Hawthorne, CA 90250  
UNITED STATES

## Buyer Information:

Buyer: Andrea Jarrett  
Email: Andrea.Jarrett@spacex.com  
Phone: (310) 970-8381

Terms	Supplier ID	Tax Terms	F.O.B.	Shipping Method	Status
50% IN ADVANCE, 30% AT SHIPPING, 20% NET 30	PVAINC	Taxable	Destination	Bestway	Released

Line	Qty	UM	Part ID / Mfg Part ID	Supplier Part ID	Service ID	Current Promise Date	Original Promise Date	Need Date	Unit Price	Total
1	1.00	EA		B72-01433		11/7/13	11/7/13	11/7/13	\$ 4,175.0000	\$ 4,175.00
<b>Description</b>  Rework the dispense system on machine serial numberW3267 to connect one cartridge to (1) one gallon tank for automatic solvent flush of Arethane 5750. - Includes all hoses and fittings needed for complete integration. - Includes one pneumatic ball valve for automatic solvent flush. - Includes hardware and software needed for integration. - Includes new one gallon tank.										
2	1.00	EA		ON-SITE		11/7/13	11/7/13	11/7/13	\$ 1,150.0000	\$ 1,150.00
<b>Description</b>  On-site from PVA to travel o Space X and install the new auto solvent flush system. -Labor rate based on 8-10 hour work day Monday through Friday non-US holiday.										
3	1.00	EA		Expenses		11/7/13	11/7/13	11/7/13	\$ 1,750.0000	\$ 1,750.00

POForm\_ERP v1

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# Material Safety Data Sheet



## ARATHANE® 5750 A

### 1. Product and company identification

**Product name** : ARATHANE® 5750 A  
**Material uses** : Component used for the manufacture of electrical insulation parts  
**(M)SDS #** : 00052694  
**Validation date** : 12/11/2013.  
**Supplier/Manufacturer** : Huntsman Advanced Materials Americas LLC  
 P.O. Box 4980  
 The Woodlands, TX 77387  
  
 Non-Emergency phone: (800) 257-5547  
  
 E-Mail: MSDS@huntsman.com

**In case of emergency** : Chemtrec: (800) 424-9300 or (703) 527-3887

### 2. Hazards identification

**Physical state** : Liquid.  
**Odor** : Aromatic.  
**Color** : Yellow.  
  
**OSHA/HCS status** : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).  
**Emergency overview** : **WARNING!**  
 FLAMMABLE LIQUID AND VAPOR. CAUSES RESPIRATORY TRACT, EYE AND SKIN IRRITATION. MAY CAUSE ALLERGIC RESPIRATORY AND SKIN REACTION. CONTAINS MATERIAL THAT CAN CAUSE TARGET ORGAN DAMAGE. POSSIBLE DEVELOPMENTAL HAZARD - CONTAINS MATERIAL WHICH MAY CAUSE ADVERSE DEVELOPMENTAL EFFECTS, BASED ON ANIMAL DATA.  
 Flammable liquid. Keep away from heat, sparks and flame. Avoid exposure - obtain special instructions before use. Do not breathe vapor or mist. Do not get on skin or clothing. Avoid contact with eyes. Avoid exposure during pregnancy. Use only with adequate ventilation. Keep container tightly closed and sealed until ready for use. Wash thoroughly after handling.

See toxicological information (Section 11)

**GENERAL INFORMATION** : Read the entire MSDS for a more thorough evaluation of the hazards.

### 3. Composition/information on ingredients

Name	CAS number	%
Diphenylmethane 4,4'-diisocyanate	101-68-8	60 - 100
MDI HOMOPOLYMER (NCO>=3) (SUBSTANCE)	39310-05-9	13 - 30
Toluene	108-88-3	7 - 13
Methylenediphenyldiisocyanate (mixed isomers)	26447-40-5	3 - 7
triethyl phosphate	78-40-0	1 - 3

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## 4. First aid measures

- Eye contact** : Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical attention immediately.
- Skin contact** : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.
- Inhalation** : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.
- Ingestion** : Wash out mouth with water. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.
- Notes to physician** : No specific treatment. Treat symptomatically. Call medical doctor or poison control center immediately if large quantities have been ingested.

## 5. Fire-fighting measures

- Flash point** : Closed cup: 31°C (87.8°F) [ASTM D 93 (Pensky-Martens Closed Cup)]
- Hazardous thermal decomposition products** : Decomposition products may include the following materials:  
carbon dioxide  
carbon monoxide  
nitrogen oxides  
phosphorus oxides
- Extinguishing media**
- Suitable** : Use dry chemical, CO<sub>2</sub>, water spray (fog) or foam.
- Not suitable** : Do not use water jet.
- Special exposure hazards** : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.
- Special protective equipment for fire-fighters** : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

## 6. Accidental release measures

- Personal precautions** : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Do not breathe vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment (see Section 8).
- Environmental precautions** : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).
- Methods for cleaning up** : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see Section 1 for emergency contact

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## 6. Accidental release measures

information and Section 13 for waste disposal.

## 7. Handling and storage

### Handling

: Put on appropriate personal protective equipment (see Section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. Persons with a history of skin sensitization problems or asthma, allergies or chronic or recurrent respiratory disease should not be employed in any process in which this product is used. Avoid exposure during pregnancy. Do not get in eyes or on skin or clothing. Do not breathe vapor or mist. Do not ingest. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use non-sparking tools. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by grounding and bonding containers and equipment before transferring material. Empty containers retain product residue and can be hazardous. Do not reuse container.

### Storage

: Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

## 8. Exposure controls/personal protection

Ingredient	Exposure limits
Diphenylmethane 4,4'-diisocyanate	ACGIH TLV (United States, 3/2012). TWA: 0.005 ppm 8 hours. OSHA PEL (United States, 6/2010). CEIL: 0.02 ppm CEIL: 0.2 mg/m <sup>3</sup>
Toluene	OSHA PEL Z2 (United States, 11/2006). TWA: 200 ppm 8 hours. CEIL: 300 ppm AMP: 500 ppm 10 minutes. ACGIH TLV (United States, 3/2012). TWA: 20 ppm 8 hours.

### Recommended monitoring procedures

: If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment. Reference should be made to appropriate monitoring standards. Reference to national guidance documents for methods for the determination of hazardous substances will also be required.

### Engineering measures

: Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

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## 8. Exposure controls/personal protection

- Hygiene measures** : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Contaminated work clothing should not be allowed out of the workplace. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.
- Personal protection**
- Respiratory** : In case of inadequate ventilation wear respiratory protection. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.
- Hands** : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated. > 8 hours (breakthrough time): Ethyl Vinyl Alcohol Laminate (EVAL), butyl rubber
- Eyes** : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles.
- Skin** : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.
- Environmental exposure controls** : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

## 9. Physical and chemical properties

- Appearance**
- Physical state** : Liquid.
- Color** : Yellow.
- Odor** : Aromatic.
- pH** : Not available.
- Boiling/condensation point** : >109°C (>228.2°F)
- Melting/freezing point** : Not available.
- Flash point** : Closed cup: 31°C (87.8°F) [ASTM D 93 (Pensky-Martens Closed Cup)]
- Flammable limits** : Not available.
- Auto-ignition temperature** : Not available.
- Vapor pressure** : Not available.
- Specific gravity** : Not available.
- Water solubility** : Reacts with water
- Partition coefficient: n-octanol/water (log Kow)** : Not available.
- Viscosity** : Dynamic (room temperature): 30 mPa·s (30 cP)

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**9 . Physical and chemical properties**

Density : 1.2 g/cm<sup>3</sup>  
 Vapor density : 8.6  
 Evaporation rate (butyl acetate = 1) : Not available.

**10 . Stability and reactivity**

**Chemical stability** : The product is stable.  
 Under normal conditions of storage and use, hazardous reactions will not occur.

**Hazardous polymerization** : Under normal conditions of storage and use, hazardous polymerization will not occur.

**Conditions to avoid** : Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition.

**Materials to avoid** : strong acids, strong bases, strong oxidising agents

**Hazardous decomposition products** : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

**11 . Toxicological information****Acute toxicity**

Product/ingredient name	Test	Endpoint	Species	Result
Diphenylmethane 4,4'-diisocyanate	OECD 403 Acute Inhalation Toxicity OECD 402 Acute Dermal Toxicity OECD 401 Acute Oral Toxicity	LC50 Inhalation Dusts and mists LD50 Dermal LD50 Oral	Rat - Male, Female Rabbit - Male, Female Rat - Male	0.49 mg/l >9400 mg/kg >10000 mg/kg
MDI HOMOPOLYMER (NCO>=3) (SUBSTANCE)	OECD 403 Acute Inhalation Toxicity OECD 402 Acute Dermal Toxicity OECD 425 Acute Oral Toxicity: Up-and-Down Procedure	LC50 Inhalation Dusts and mists LD50 Dermal LD50 Oral	Rat - Male, Female Rabbit - Male, Female Rat - Female	0.49 mg/l >9400 mg/kg >5000 mg/kg
Toluene	OECD 403 Acute Inhalation Toxicity Unknown guidelines EU EC B.1 Acute Toxicity (Oral)	LC50 Inhalation Vapor LD50 Dermal LD50 Oral	Rat - Male, Female Rabbit Rat - Male	28.1 mg/l >5000 mg/kg 5580 mg/kg
Methylenediphenyldiisocyanate (mixed isomers)	OECD 403 Acute Inhalation Toxicity OECD 403 Acute Inhalation Toxicity OECD 402 Acute Dermal Toxicity No official guidelines	LC50 Inhalation Dusts and mists LC50 Inhalation Dusts and mists LD50 Dermal LD50 Oral	Rat - Male, Female Rat - Male, Female Rabbit - Male, Female Rat - Male, Female	>2.24 mg/l 0.49 mg/m <sup>3</sup> >9400 mg/kg >2000 mg/kg
triethyl phosphate	OECD 403 Acute Inhalation Toxicity - -	LC50 Inhalation Dusts and mists LD50 Dermal LD50 Oral	Rat - Male, Female Rabbit Rat	>8817 mg/m <sup>3</sup> >20000 mg/kg 1600 mg/kg

**Conclusion/Summary** : Diphenylmethane 4,4'-diisocyanate Irritating to respiratory system.

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## 11 . Toxicological information

### Irritation/Corrosion

Product/ingredient name	Test	Species	Result
Diphenylmethane 4,4'-diisocyanate	OECD 404 Acute Dermal Irritation/Corrosion	Rabbit	Skin - Irritant
	OECD 405 Acute Eye Irritation/Corrosion	Rabbit	Eyes - Non-irritant.
MDI HOMOPOLYMER (NCO>=3) (SUBSTANCE)	OECD 405 Acute Eye Irritation/Corrosion	Rabbit	Eyes - Non-irritant.
	-	Rabbit	Skin - Irritant
Toluene	EU	Rabbit	Skin - Irritant
	OECD 405 Acute Eye Irritation/Corrosion	Rabbit	Eyes - Mild irritant
triethyl phosphate	OECD 404 Acute Dermal Irritation/Corrosion	Rabbit	Skin - Non-irritant.
	OECD 405 Acute Eye Irritation/Corrosion	Rabbit	Eyes - Moderate irritant

### Conclusion/Summary

#### **Skin**

- : Diphenylmethane 4,4'-diisocyanate Irritating to skin.
- MDI HOMOPOLYMER (NCO>=3) (SUBSTANCE) Irritating to skin.
- Toluene Irritating to skin.
- Methylenediphenyldiisocyanate (mixed isomers) No additional information.
- triethyl phosphate Non-irritating to the skin.

#### **Eyes**

- : Diphenylmethane 4,4'-diisocyanate Based on the human occupational exposure data, this substance is considered as irritating to eyes.
- MDI HOMOPOLYMER (NCO>=3) (SUBSTANCE) Based on the human occupational exposure data, this substance is considered as irritating to eyes.
- Toluene Non-irritating to the eyes.
- Methylenediphenyldiisocyanate (mixed isomers) No additional information.
- triethyl phosphate Irritating to eyes.

#### **Respiratory**

- : Diphenylmethane 4,4'-diisocyanate No additional information.
- MDI HOMOPOLYMER (NCO>=3) (SUBSTANCE) No additional information.
- Toluene No additional information.
- Methylenediphenyldiisocyanate (mixed isomers) No additional information.
- triethyl phosphate No additional information.

### Sensitizer

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**11 . Toxicological information**

Product/ingredient name	Test	Route of exposure	Species	Result
Diphenylmethane 4,4'-diisocyanate	OECD 429 Skin Sensitization: Local Lymph Node Assay	skin	Mouse	Sensitizing
	OECD 406 Skin Sensitization	skin	Guinea pig	Not sensitizing
	No official guidelines	Respiratory	Guinea pig	Sensitizing
MDI HOMOPOLYMER (NCO>=3) (SUBSTANCE)	OECD 406 Skin Sensitization	skin	Guinea pig	Sensitizing
	No official guidelines	Respiratory	Guinea pig	Sensitizing
Toluene	EU EC B.6 Skin Sensitisation	skin	Guinea pig	Not sensitizing
Methylenediphenyldiisocyanate (mixed isomers)	OECD 406 Skin Sensitization	skin	Guinea pig	Not sensitizing
	No official guidelines	Respiratory	Guinea pig	Sensitizing
	OECD 429 Skin Sensitization: Local Lymph Node Assay	skin	Mouse	Sensitizing
triethyl phosphate	OECD 429 Skin Sensitization: Local Lymph Node Assay	skin	Mouse	Not sensitizing

**Mutagenicity**

Product/ingredient name	Test	Result
Diphenylmethane 4,4'-diisocyanate	Experiment: In vitro Subject: Bacteria Metabolic activation: +/-	Negative
	Experiment: In vivo Subject: Mammalian-Animal	Negative
MDI HOMOPOLYMER (NCO>=3) (SUBSTANCE)	Experiment: In vitro Subject: Bacteria Metabolic activation: +/-	Negative
	Experiment: In vivo Subject: Mammalian-Animal	Negative
Toluene	Experiment: In vitro Subject: Mammalian-Animal Cell: Somatic Metabolic activation: +/-	Negative
	Experiment: In vivo Subject: Mammalian-Animal	Negative
Methylenediphenyldiisocyanate (mixed isomers)	Experiment: In vitro Subject: Bacteria Metabolic activation: +/-	Negative
	Experiment: In vivo Subject: Mammalian-Animal	Negative
triethyl phosphate	Experiment: In vitro Subject: Bacteria Experiment: In vitro Subject: Mammalian-Animal	Negative

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**11 . Toxicological information**

Metabolic activation: +/- Experiment: In vitro Subject: Mammalian-Animal Cell: Somatic	Negative
Experiment: In vivo Subject: Mammalian-Animal	Negative

**Conclusion/ Summary** : Diphenylmethane 4,4'-diisocyanate triethyl phosphate No mutagenic effect.  
No mutagenic effect.

**Carcinogenicity**

Product/ingredient name	Test	Species	Dose	Exposure	Result/Result type
Diphenylmethane 4,4'-diisocyanate	OECD 453 Combined Chronic Toxicity/ Carcinogenicity Studies	Rat - Male, Female	1 mg/m <sup>3</sup>	2 years; 5 days per week	Positive - Inhalation - NOAEL
MDI HOMOPOLYMER (NCO>=3) (SUBSTANCE)	OECD 453 Combined Chronic Toxicity/ Carcinogenicity Studies	Rat - Male, Female	1 mg/m <sup>3</sup>	2 years; 5 days per week	Negative - Inhalation - NOAEL
Toluene	OECD 453 Combined Chronic Toxicity/ Carcinogenicity Studies	Rat - Male, Female	4522 mg/m <sup>3</sup>	103 weeks; 6. 5 hours per day	Negative - Inhalation - NOAEL
Methylenediphenyldiisocyanate (mixed isomers)	OECD 453 Combined Chronic Toxicity/ Carcinogenicity Studies	Rat - Male, Female	1 mg/m <sup>3</sup>	2 years; 5 days per week	Negative - Inhalation - NOAEL

**Carcinogenic class**

Product/ingredient name	ACGIH	IARC	EPA	NIOSH	NTP	OSHA
Diphenylmethane 4,4'-diisocyanate	-	3	-	-	-	-
Toluene	A4	3	-	-	-	-

**Reproductive toxicity**

Product/ingredient name	Test	Species	Maternal toxicity	Fertility	Developmental effects
Toluene	OECD 416 Two-Generation Reproduction Toxicity Study	Rat - Male, Female	Positive	Negative	Positive
Methylenediphenyldiisocyanate (mixed isomers)	OECD 414 Prenatal Developmental Toxicity Study	Rat - Male, Female	Negative	Negative	Negative

**Conclusion/ Summary** :

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## 11. Toxicological information

Diphenylmethane 4,4'-  
diisocyanate  
triethyl phosphate

No known significant effects or critical hazards.

In accordance with column 2 of Annex VII - X of Regulation (EC) No 1907/2006, the test for this property of the substance does not need to be conducted.

### Teratogenicity

Product/ingredient name	Test	Species	Result/Result type
Diphenylmethane 4,4'-diisocyanate	OECD 414 Prenatal Developmental Toxicity Study	Rat - Female	Negative - Inhalation
MDI HOMOPOLYMER (NCO>=3) (SUBSTANCE)	OECD 414 Prenatal Developmental Toxicity Study	Rat - Female	Negative - Inhalation
Toluene	EPA CFR	Rat - Female	Negative - Inhalation
Methylenediphenyldiisocyanate (mixed isomers)	OECD 414 Prenatal Developmental Toxicity Study	Rat - Female	Negative - Inhalation
triethyl phosphate	OECD 414 Prenatal Developmental Toxicity Study	Rat	Negative - Oral

### Conclusion/ Summary

: Diphenylmethane 4,4'-  
diisocyanate  
triethyl phosphate

No known significant effects or critical hazards.

No known significant effects or critical hazards.

### Potential acute health effects

**Inhalation** : Irritating to respiratory system. May cause sensitization by inhalation.  
**Ingestion** : No known significant effects or critical hazards.  
**Skin contact** : Irritating to skin. May cause sensitization by skin contact.  
**Eye contact** : Irritating to eyes.

### Potential chronic health effects

Product/ingredient name	Test	Endpoint	Species	Result
MDI HOMOPOLYMER (NCO>=3) (SUBSTANCE)	OECD 453 Combined Chronic Toxicity/ Carcinogenicity Studies	Chronic NOEC Inhalation Dusts and mists	Rat - Male, Female	0.2 mg/m³
Toluene	EU	Sub-chronic NOAEL Oral	Rat - Male, Female	625 mg/kg
	OECD 453 Combined Chronic Toxicity/ Carcinogenicity Studies	Chronic LOEC Inhalation Vapor	Rat - Male, Female	600 ppm
Methylenediphenyldiisocyanate (mixed isomers)	OECD 453 Combined Chronic Toxicity/ Carcinogenicity Studies	Chronic NOEC Inhalation Dusts and mists	Rat - Male, Female	0.2 mg/m³
triethyl phosphate	EU	Sub-acute NOAEL Oral	Rat - Male, Female	1000 mg/kg
	-	Sub-chronic NOEC	Rat - Male	366 mg/m³

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PVA\SPCX2115\Space X add auto flush system\

PVA-0310

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<b>11 . Toxicological information</b>				
		Inhalation Dusts and mists		

**General** : Contains material that can cause target organ damage. Once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels.

**Target organs** : Contains material which causes damage to the following organs: upper respiratory tract.  
Contains material which may cause damage to the following organs: kidneys, the nervous system, liver, brain, central nervous system (CNS).

**Carcinogenicity** : No known significant effects or critical hazards.

**Mutagenicity** : No known significant effects or critical hazards.

**Teratogenicity** : No known significant effects or critical hazards.

**Developmental effects** : Contains material which may cause developmental abnormalities, based on animal data.

**Fertility effects** : No known significant effects or critical hazards.

**Medical conditions aggravated by over-exposure**

Pre-existing respiratory and skin disorders and disorders involving any other target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

## 12 . Ecological information

**Environmental effects** : No known significant effects or critical hazards.

**Aquatic ecotoxicity**

Product/ingredient name	Test	Endpoint	Exposure	Species	Result
Diphenylmethane 4,4'-diisocyanate	OECD 202 <i>Daphnia</i> sp. Acute Immobilisation Test	Acute	EC50	24 hours Static	Daphnia >1000 mg/l
	OECD 203 Fish, Acute Toxicity Test	Acute	LC50	96 hours Static	Fish >1000 mg/l
	OECD 211 <i>Daphnia Magna</i> Reproduction Test	Chronic	NOEC	21 days Semi-static	Daphnia >10 mg/l
	OECD 201 Alga, Growth Inhibition Test	Chronic	NOEC	72 hours Static	Algae 1640 mg/l
MDI HOMOPOLYMER (NCO>=3) (SUBSTANCE)	OECD 201 Alga, Growth Inhibition Test	Acute	EC50	72 hours Static	Algae >1640 mg/l
	OECD 209 Activated Sludge, Respiration Inhibition Test	Acute	EC50	3 hours Static	Bacteria >100 mg/l
	OECD 202 <i>Daphnia</i> sp. Acute Immobilisation Test	Acute	EC50	24 hours Static	Daphnia >1000 mg/l
	OECD 203 Fish, Acute Toxicity Test	Acute	LC50	96 hours Static	Fish >1000 mg/l
Toluene	OECD 211 <i>Daphnia Magna</i> Reproduction Test	Chronic	NOEC	21 days Semi-static	Daphnia >10 mg/l
	OECD 201 Alga, Growth Inhibition Test	Chronic	NOEC	72 hours Static	Algae 1640 mg/l
	EPA CFR	Acute	EC50	48 hours Renewal	Daphnia 3.78 mg/l

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PVA-0311



ARATHANE® 5750 A

**12 . Ecological information**

Methylenediphenyldiisocyanate (mixed isomers)	-	Acute	LC50	96 hours Flow-through	Fish	5.5	mg/l
	Unknown guidelines	Chronic	NOEC	40 days Flow-through	Fish	1.39	mg/l
	EPA CFR	Chronic	NOEC	7 days Renewal	Daphnia	0.74	mg/l
	OECD 201 Alga, Growth Inhibition Test	Acute	EC50	72 hours Static	Algae	>1640	mg/l
	OECD 209 Activated Sludge, Respiration Inhibition Test	Acute	EC50	3 hours Static	Bacteria	>100	mg/l
	OECD 202 <i>Daphnia</i> sp. Acute Immobilisation Test	Acute	EC50	24 hours Static	Daphnia	>1000	mg/l
	OECD 203 Fish, Acute Toxicity Test	Acute	LC50	96 hours Static	Fish	>1000	mg/l
	OECD 211 <i>Daphnia Magna</i> Reproduction Test	Chronic	NOEC	21 days Semi-static	Daphnia	>10	mg/l
	OECD 201 Alga, Growth Inhibition Test	Chronic	NOEC	72 hours Static	Algae	1640	mg/l
	-	Acute	EC50	72 hours Static	Algae	901	mg/l
triethyl phosphate	EPA OPPTS	Acute	LC50	96 hours Static	Daphnia	>100	mg/l
	-	Acute	LC50	96 hours Static	Fish	>100	mg/l
	EPA OPPTS	Acute	LC50	96 hours Static	Fish	>100	mg/l
	-	Chronic	EC10	30 minutes Static	Bacteria	2985	mg/l
	OECD 211 <i>Daphnia Magna</i> Reproduction Test	Chronic	NOEC	21 days	Daphnia	31.6	mg/l

**Conclusion/Summary** : triethyl phosphate Not toxic or harmful to aquatic organisms.

**Persistence and degradability**

Product/ingredient name	Test	Period	Result
Diphenylmethane 4,4'-diisocyanate	OECD 302C Inherent Biodegradability: Modified MITI Test (II)	28 days	0 %
MDI HOMOPOLYMER (NCO>=3) (SUBSTANCE)	OECD 302C Inherent Biodegradability: Modified MITI Test (II)	28 days	0 %
Toluene	ASTM	5 days	81 %
Methylenediphenyldiisocyanate (mixed isomers)	OECD 302C Inherent Biodegradability: Modified MITI Test (II)	28 days	0 %
triethyl phosphate	EPA OPPTS 302B Inherent Biodegradability: Zahn-Wellens/EMPA Test	28 days	98 %
	OECD 301C Ready Biodegradability - Modified MITI Test (I)	28 days	0 %

**Conclusion/Summary** : Diphenylmethane 4,4'-diisocyanate Not biodegradable  
triethyl phosphate Inherently biodegradable

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**12 . Ecological information**

Product/ingredient name	Aquatic half-life	Photolysis	Biodegradability
Diphenylmethane 4,4'-diisocyanate	Fresh water 0.83 days	-	Not readily
MDI HOMOPOLYMER (NCO>=3) (SUBSTANCE)	-	-	Not readily
Toluene	-	-	Readily
Methylenediphenyldiisocyanate (mixed isomers)	-	-	Not readily
triethyl phosphate	Fresh water 2007.5 days	-	Not readily

**Bioaccumulative potential**

Product/ingredient name	LogP <sub>ow</sub>	BCF	Potential
Diphenylmethane 4,4'-diisocyanate	4.51	200	low
MDI HOMOPOLYMER (NCO>=3) (SUBSTANCE)	8.56	200	low
Toluene	2.73	-	low
Methylenediphenyldiisocyanate (mixed isomers)	4.51	439	low
triethyl phosphate	1.11	0.5 to 0.8	low

**Other adverse effects** : No known significant effects or critical hazards.

**Other ecological information**

**BOD5** : Not Determined

**COD** : Not Determined

**TOC** : Not Determined

**13 . Disposal considerations**

**Waste disposal** : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Vapor from product residues may create a highly flammable or explosive atmosphere inside the container. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Disposal should be in accordance with applicable regional, national and local laws and regulations.

**14 . Transport information****Proper shipping name**

**DOT** : RESIN SOLUTION

**TDG** : RESIN SOLUTION

**IMDG** : RESIN SOLUTION

**IATA** : RESIN SOLUTION





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**14 . Transport information**

Regulatory information	UN number	Classes	PG*	Label	Additional information
<b>DOT Classification</b>	UN1866	3	III		<b>Reportable quantity</b> 8234.5 lbs / 3738.5 kg [823 gal / 3115.4 L] Package sizes shipped in quantities less than the product reportable quantity are not subject to the RQ (reportable quantity) transportation requirements.
<b>TDG Classification</b>	UN1866	3	III		-
<b>IMDG Class</b>	UN1866	3	III		<b>Emergency schedules (EmS)</b> F-E, _S-E_
<b>IATA-DGR Class</b>	UN1866	3	III		<b>Passenger and Cargo Aircraft</b> Quantity limitation: 60 L Packaging Instructions: 355 <b>Cargo Aircraft Only</b> Quantity limitation: 220 L Packaging instructions: 366

PG\* : Packing group

**15 . Regulatory information**United States

**HCS Classification** : Flammable liquid  
Irritating material  
Sensitizing material  
Target organ effects

**U.S. Federal regulations**

**TSCA 8(b) inventory** : **United States inventory (TSCA 8b):** All components are listed or exempted.

**TSCA 5(a)2 final** : No ingredients listed.

**significant new use rule (SNUR)**

**TSCA 5(e) substance consent order** : No ingredients listed.

**TSCA 12(b) export notification** : No ingredients listed.

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## 15. Regulatory information

**SARA 311/312** : Fire hazard  
Immediate (acute) health hazard  
Delayed (chronic) health hazard

	<u>Product name</u>	<u>CAS number</u>	<u>Concentration %</u>
<b>Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs)</b>	Diphenylmethane 4,4'-diisocyanate	101-68-8	60.72
	Toluene		8

**Clean Air Act - Ozone Depleting Substances (ODS)** : EPCRA Section 313 (40 CFR 372) CERCLA (Comprehensive Environmental Response, Compensation and Liability Act): 4,4-Methylene diphenyl diisocyanate (CAS 101-68-8) has a 5,000 lb. RQ (reportable quantity). Any spill or release above the RQ must be reported to the National Response Center (800-424-8802).

This product does not contain nor is it manufactured with ozone depleting substances.

	<u>Product name</u>	<u>CAS number</u>	<u>Concentration %</u>
<b>SARA 313</b>	Diphenylmethane 4,4'-diisocyanate	101-68-8	60.72
<b>Form R - Reporting requirements</b>	Toluene	108-88-3	7.9928

**CERCLA Hazardous substances** :

Components	Concentration %	Section 304 CERCLA Hazardous Substance	CERCLA Reportable Quantity (Lbs)	Product Reportable Quantity (Lbs)
Diphenylmethane 4,4'-diisocyanate	60.72	Listed	5000	8235
Toluene	7.9928	Listed	1000	12511

### State regulations

**PENNSYLVANIA - RTK** : Diphenylmethane 4,4'-diisocyanate, toluene

**California Prop 65** : **WARNING:** This product contains a chemical known to the State of California to cause birth defects or other reproductive harm.

<u>Ingredient name</u>	<u>Cancer</u>	<u>Reproductive</u>
Toluene	No	Yes

### International regulations

**Canada**

**WHMIS (Canada)**

: Class B-2: Flammable liquid  
Class D-2A: Material causing other toxic effects (Very toxic).  
Class D-2B: Material causing other toxic effects (Toxic).

**CEPA DSL**

: All components are listed or exempted.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.

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## 15. Regulatory information

### International lists

: **Australia inventory (AICS):** All components are listed or exempted.  
**China inventory (IECSC):** All components are listed or exempted.  
**Japan inventory:** All components are listed or exempted.  
**Korea inventory:** All components are listed or exempted.  
**Malaysia inventory (EHS Register):** Not determined.  
**New Zealand Inventory of Chemicals (NZIoC):** All components are listed or exempted.  
**Philippines inventory (PICCS):** All components are listed or exempted.  
**Taiwan inventory (CSNN):** Not determined.

## 16. Other information

### Label requirements

: FLAMMABLE LIQUID AND VAPOR. CAUSES RESPIRATORY TRACT, EYE AND SKIN IRRITATION. MAY CAUSE ALLERGIC RESPIRATORY AND SKIN REACTION. CONTAINS MATERIAL THAT CAN CAUSE TARGET ORGAN DAMAGE. POSSIBLE DEVELOPMENTAL HAZARD - CONTAINS MATERIAL WHICH MAY CAUSE ADVERSE DEVELOPMENTAL EFFECTS, BASED ON ANIMAL DATA.

### Hazardous Material

### Information System (U.S.A.)

Health	2
Flammability	3
Physical hazards	1
Personal protection	

The customer is responsible for determining the PPE code for this material.

### National Fire Protection Association (U.S.A.)



Date of printing : 12/11/2013.

Date of issue : 12/11/2013.

Date of previous issue : 8/08/2008

Version : 3

Indicates information that has changed from previously issued version.

### Notice to reader

While the information and recommendations in this publication are to the best of our knowledge, information and belief accurate at the date of publication, NOTHING HEREIN IS TO BE CONSTRUED AS A WARRANTY, EXPRESS OR OTHERWISE.

IN ALL CASES, IT IS THE RESPONSIBILITY OF THE USER TO DETERMINE THE APPLICABILITY OF SUCH INFORMATION AND RECOMMENDATIONS AND THE SUITABILITY OF ANY PRODUCT FOR ITS OWN PARTICULAR PURPOSE.

THE PRODUCT MAY PRESENT HAZARDS AND SHOULD BE USED WITH CAUTION. WHILE CERTAIN HAZARDS ARE DESCRIBED IN THIS PUBLICATION, NO GUARANTEE IS MADE THAT THESE ARE THE ONLY HAZARDS

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## 16 . Other information

THAT EXIST.

*Hazards, toxicity and behaviour of the products may differ when used with other materials and are dependent upon the manufacturing circumstances or other processes. Such hazards, toxicity and behaviour should be determined by the user and made known to handlers, processors and end users.*

**NO PERSON OR ORGANIZATION EXCEPT A DULY AUTHORIZED HUNTSMAN EMPLOYEE IS AUTHORIZED TO PROVIDE OR MAKE AVAILABLE DATA SHEETS FOR HUNTSMAN PRODUCTS. DATA SHEETS FROM UNAUTHORIZED SOURCES MAY CONTAIN INFORMATION THAT IS NO LONGER CURRENT OR ACCURATE. NO PART OF THIS DATA SHEET MAY BE REPRODUCED OR TRANSMITTED IN ANY FORM, OR BY ANY MEANS, WITHOUT PERMISSION IN WRITING FROM HUNTSMAN. ALL REQUESTS FOR PERMISSION TO REPRODUCE MATERIAL FROM THIS DATA SHEET SHOULD BE DIRECTED TO HUNTSMAN, MANAGER, PRODUCT SAFETY AT THE ABOVE ADDRESS.**

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PVA\SPCX2115\Space X add auto flush  
system\

EXHIBIT 22

203 PVA-0317

# PVA

ISSUE DATE		8/27/2012		PART/ASSEMBLY:		Technosoft drive upgrade on machine serial number R1012		BILL OF MATERIAL		B72-0898	
REV. DATE										SHEET 1 of 1 REVISION A	
ITEM	DESCRIPTION			SYMBOL	QTY	UNIT	REC SP	DATE	REMARKS		
1.											
2.											
3.											
4.											
5.											
6.											
7.											
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18.											
19.											
20.											
21.											
22.											



# QUOTATION

**DATE**  
9/19/2013

**QUOTATION NUMBER**  
131909W3267

1 Mustang Drive Cohoes NY, 12047

Tel 518 371 2684 ext 2421

Fax 518 371 2688

JConnelly@pva.net

www.pva.net

**TO:**  
Duc Q. Phan  
SpaceX  
1 Rocket Road  
Hawthorne, CA 90250

*This fax is intended to be viewed only by the person that is addressed to. This fax is confidential in nature, and subject to copyright protection. If you are not the intended recipient or the agent of the intended or if you are unable to deliver this communication to the intended recipient, please do not read, copy, or use this communication to show it to any other person, but notify the sender immediately by telephone at (518) 371-2684.*

QTY	MODEL	DESCRIPTION	Price/ ea	Extended
1	872-01433	Rework the dispense system on machine serial number W3267 to connect one cartridge to (1) one gallon tank for automatic solvent flush of Arethane 5705. <ul style="list-style-type: none"> <li>Includes all hoses and fittings needed for complete integration</li> <li>Includes one pneumatic ball valve for automatic solvent flush</li> <li>Includes hardware and software needed for integration.</li> <li>Includes new one gallon tank.</li> </ul>	\$4,175.00	\$4,175.00
1	ON-SITE	On-site from PVA to travel o Space X and install the new auto solvent flush system. <ul style="list-style-type: none"> <li>Labor rate based on 8-10 hour work day Monday through Friday non-US holiday.</li> </ul>	\$1,150.00	\$1,150.00
1	Expenses	Estimate of the direct travel expenses to travel from Cohoes NY to Hawthorne CA for one full day on-site. <ul style="list-style-type: none"> <li>Expenses to include but not limited to airfare, lodging, ground transportation and meals.</li> <li>Estimate can be used as a not to exceed limit.</li> </ul>	\$1,750.00	\$1,750.00

**Total: \$7,075.00**

TERMS	DELIVERY	SHIPMENT	WARRANTY
100% Net 30	6 weeks ARO	FOB PVA Factory Cohoes NY USA, + crating charge of up to \$500 (if applicable)	1 Year on all parts and labor Excluding soft seats.


## ORDER CANCELLATION POLICY

Buyer may only cancel the order for equipment in writing with a cancel charge as per the following schedule:

**Cancellation Notice Received**  
0-30 days from order date  
31-60 days from order date  
More than 60 days from order date

**Cancellation Fee Multiplier**  
25%  
35%  
70%

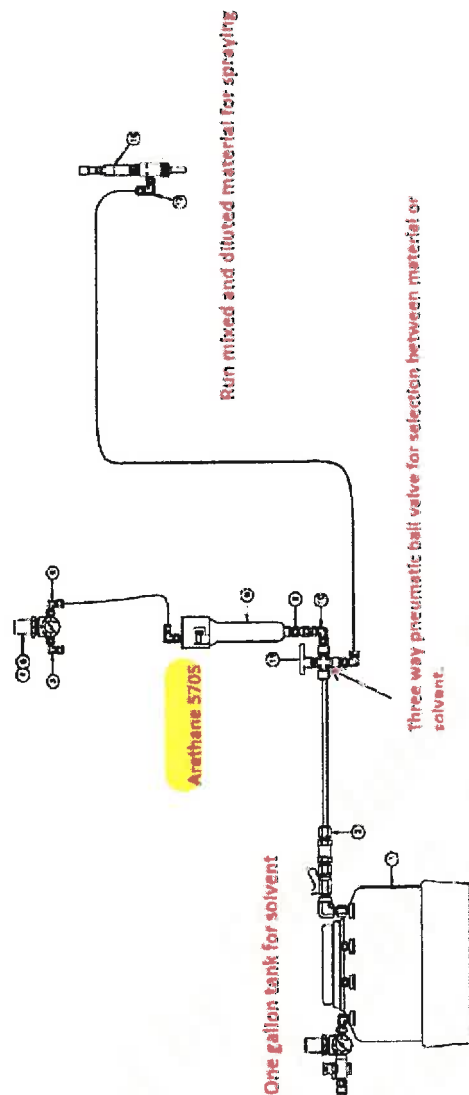
**AUTHORIZED SIGNATURE**



---

Jon Connelly  
Technical Sales

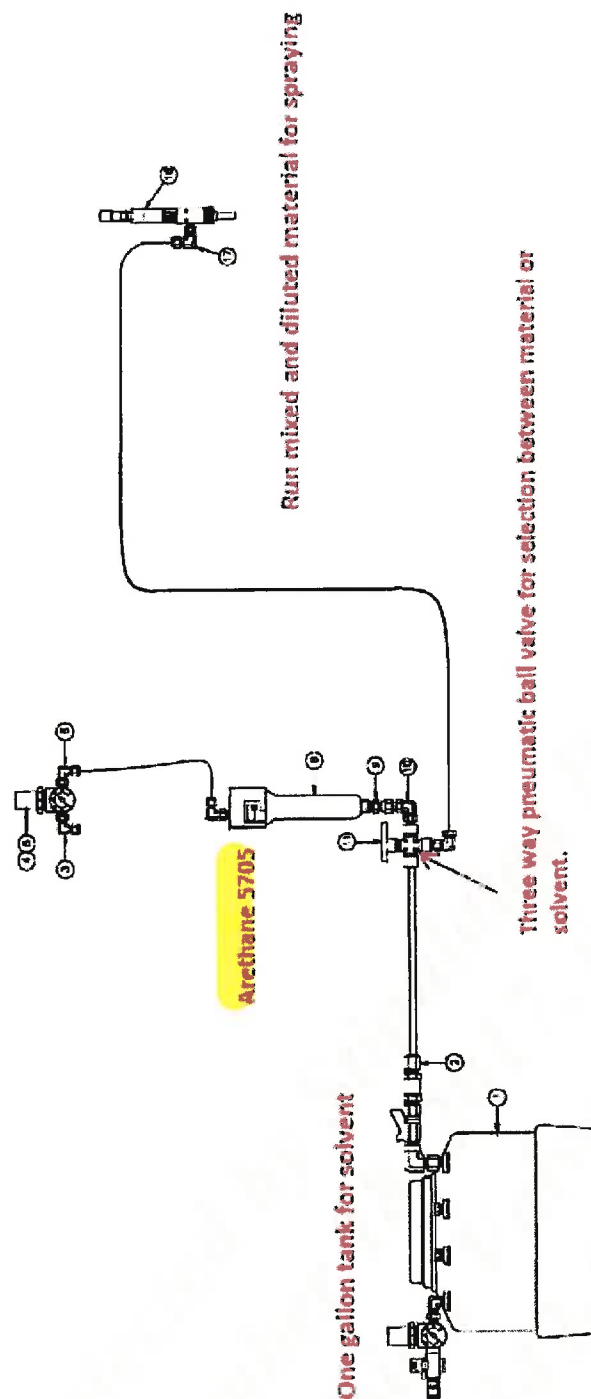
This quotation is valid for 60 days from the date of issue and does not include any applicable federal, state, or local taxes. Prices are subject to change at anytime after this quotation has expired. This quotation can only be withdrawn or modified prior to expiration date by written notice from PVA to you. No terms and conditions stated on the Purchase Order shall modify the terms or conditions contained in this proposal.

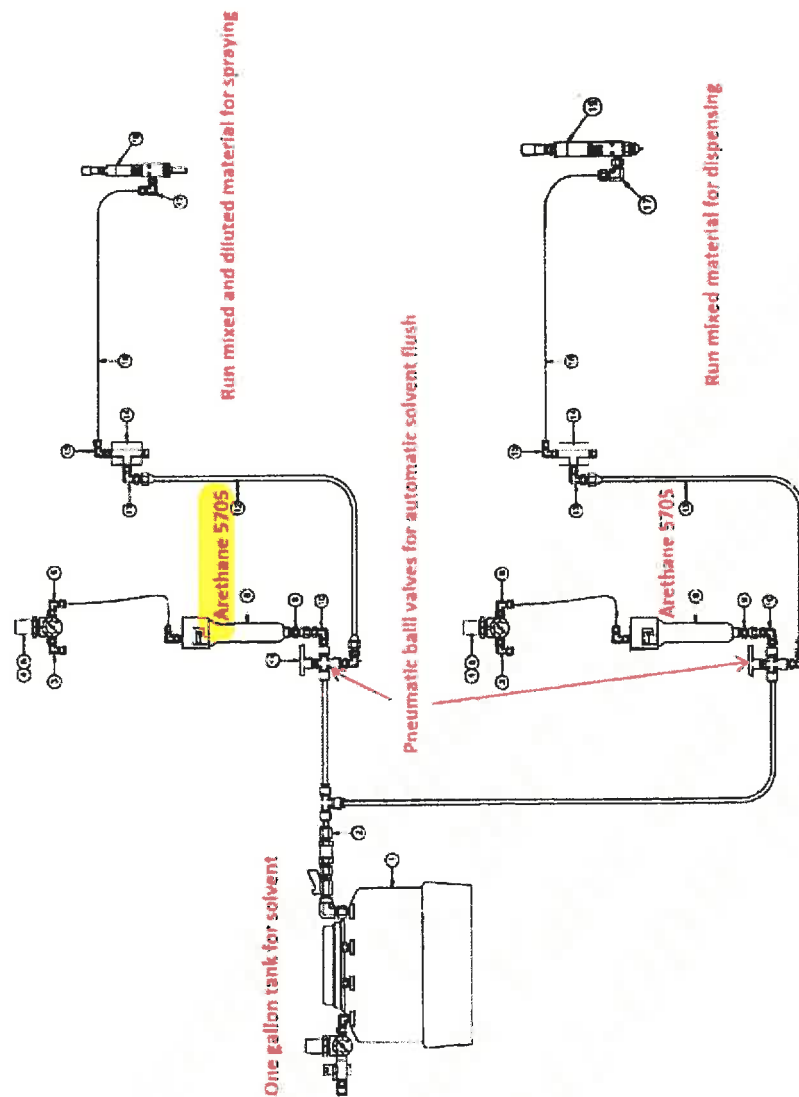


PVA\SPCX2115\Space X add auto flush system\

PVA-0343

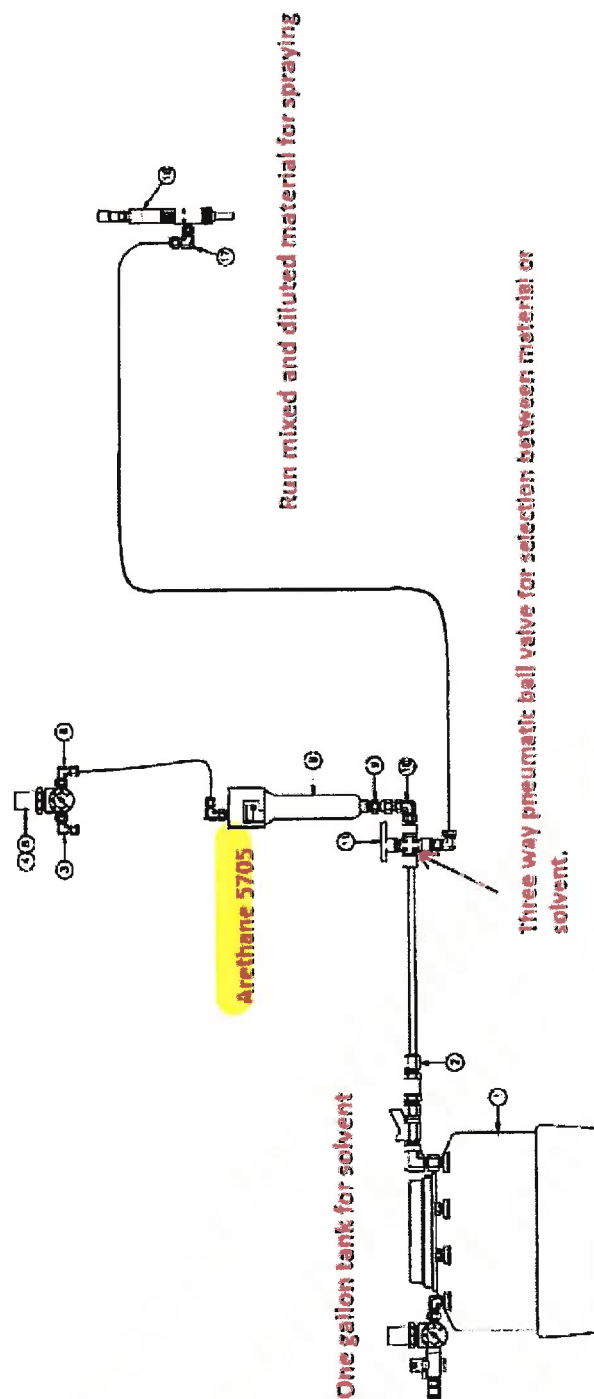






PVA\SPCX2115\Space X add auto flush system\

PVA-0345





line	Description	Part Number	Qty	Cost	Ext cost	Price	Ext price
1					\$ -	\$ -	-
2					\$ -	\$ -	-
3					\$ -	\$ -	-
4	ASSEMBLY ACTUATED AIR 3-WAY BALL VALVE	ss-43GxF4-51D	1	\$ 360.66	\$ 360.66	\$ 1,081.98	\$ 1,081.98
5	Prestand Tank, 1-Gallon Stainless Steel Reservoir Assy.	PVALC	1	\$ 469.53	\$ 825.00	\$ 825.00	\$ 825.00
6	Hoses and fittings : misc	Hoses and fittings	1	\$ 450.00	\$ 450.00	\$ 1,350.00	\$ 1,350.00
7	VALVE SEALING POS CENTER CLOSED	VQ100L-51	1	\$ 52.20	\$ 52.20	\$ 156.60	\$ 156.60
8	Programming and engineering	P-E	3	\$ 95.00	\$ 760.00	\$ 95.00	\$ 760.00
9					\$ -	\$ -	-
10					\$ -	\$ -	-
11					\$ -	\$ -	-
12					\$ -	\$ -	-
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30					\$ -	\$ -	-
					\$ -	\$ -	-
					\$ -	\$ -	-
					\$ -	\$ -	-
					\$ -	\$ -	-
Totals				\$ 1,427.39	\$ 2,447.86	\$ 3,508.58	\$ 4,173.58

---

**Subject:** RE: Customer

**Start:** Thu 8/1/2013 10:00 AM

**End:** Thu 8/1/2013 10:30 AM

**Recurrence:** (none)

**Organizer:** David Gomez

-----

**From:** Brian Ignaut <Brian.Ignaut@spacex.com>

**Sent:** Wednesday, January 09, 2013 1:24 PM

**To:** David Gomez

**Subject:** RE: Customer

David,

Thanks for your email and the follow-up. This purchase would happen in the second half of 2013 at the earliest so we have some time to wait. We'll continue to stay in touch as the year progresses and we better understand our exact technical requirements and timeline.

Sincerely,

Brian

-----Original Message-----

**From:** David Gomez [mailto:DGomez@PVA.net]

**Sent:** Wednesday, January 09, 2013 10:38 AM

**To:** Brian Ignaut

**Subject:** RE: Customer

Dear Brian,

Hope you had a joyful Holliday season and that such delight had provided you with the necessary energy to begin this new year.

I just wanted to do some follow up on the two part material application project you were working on and kindly presented us with.

You think there'd be any new developments on this matter during the first months of 2013?.....

If we can be of service to you regarding this or other new products ,please let me know.

I look forward to hearing from you.



I will call you Wednesday and discuss this further.

Brian, it would help to have a minimum and maximum shot size parameters. Since this is not a production line, I would assume cycle time is not an issue. I will call you first thing Wednesday.

Best regards,

Scott Abarta  
Engineered Sales  
Ellsworth Adhesives  
Cell: 949-742-9827

On Dec 3, 2012, at 12:01 PM, "David Gomez" <DGomez@PVA.net<mailto:DGomez@PVA.net>> wrote:

Hi Scott

It's nice to hear from you.

Can you please provide me with two part material brand and part # (if you have MSDs and data sheets even better) Also I'd need shot size and cycle time per part if possible

Regards,  
David Gomez

Sent via BlackBerry by AT&T

---

From: Scott Abarta <sabarta@Ellsworth.com<mailto:sabarta@Ellsworth.com>>

Date: Mon, 3 Dec 2012 18:19:32 +0000

To: DGomez@PVA.net<mailto:DGomez@PVA.net><DGomez@PVA.net<mailto:DGomez@PVA.net>>

Cc:

'Brian.Ignaut@spacex.com<mailto:Brian.Ignaut@spacex.com>'<Brian.Ignaut@spacex.com<mailto:Brian.Ignaut@spacex.com>>

Subject: Customer

Hello Dave,

Hope all is well. I have a customer whom I have been working with that needs a quote for the following PVA equipment:

Mx 3000 MMD machine

PVA 200 dispense valve

PVA 3000 dispense robot

Please address the quote to Brian Ignaut (below) and call me if you have any questions.

Brian Ignaut  
Responsible Engineer, Solar Arrays  
<image001.jpg>  
1 Rocket Road  
Hawthorne, CA 90250

---

**From:** David Gomez  
**Sent:** Tuesday, September 10, 2013 11:04 AM  
**To:** Jonathan Connelly; Richard Bievenue  
**Cc:** David Filbert; Michael R. Leonard; Jonathan Urquhart  
**Subject:** RE: meter-mix application

Hey mang,

No need for Dave and his metering mix systems.

Looks like they only want a 20oz cartridge retainer&cap with spray & needle valve for the pre-mix material and a 6oz cartridge retainer&cap for the solvent ,so it can flush the premixed material out right after doing a batch of boards.

I've done this fluid delivery line several times.

Let me know if you need a project # for reference,Urquhart can also tell you how this is done

Regarding options for spraying two part coatings --we are not there yet.

David E Gomez  
PVA  
Account Executive  
281 217 7247

**From:** Jonathan Connelly  
**Sent:** Tuesday, September 10, 2013 10:10 AM  
**To:** Richard Bievenue  
**Cc:** David Filbert; David Gomez; Michael R. Leonard  
**Subject:** RE: meter-mix application

It is going to be a long time before I could do any real work on a full MMX system for them... unless Dave f wants to work on that part.

I could set them up with a quote for a syringe system for premixed material...

**From:** Richard Bievenue  
**Sent:** Monday, September 09, 2013 2:12 PM  
**To:** Jonathan Connelly  
**Cc:** David Filbert; David Gomez; Michael R. Leonard  
**Subject:** meter-mix application

Jon,

I just spoke with an engineer from SpaceX named Duc Phan (pronounced "Dook Fawn"). They have one of our 350 machines, s/n W3267. They want to switch to a 2-part material, Huntsman Arathane 5750. They are currently considering just pre-mixing the material and then flushing it out after a couple hours, using a series of valves and solvent tanks. Mike Leonard may be assisting them with getting the electrical schematics and discussing program options with them in case they try to do this on their own.

They would also like to hear what options we have for them as far as a 2-component meter-mix system. Can you contact Duc and let him know you would be the man to pick up the ball on this? Then we can discuss what the best configuration would be.

Contact info:

[Duc.phan@spacex.com](mailto:Duc.phan@spacex.com)  
Ph: 310-363-6316

Best Regards,

Rich Bievenue  
Fluid Systems Engineer



1 Mustang Drive  
Cohoes, NY 12047  
Ph: 518-371-2684 x2203  
[rbievenue@pva.net](mailto:rbievenue@pva.net)

---

**From:** David Filbert  
**Sent:** Tuesday, September 10, 2013 11:05 AM  
**To:** David Gomez; Jonathan Connelly; Richard Bievenue  
**Cc:** Michael R. Leonard; Jonathan Urquhart  
**Subject:** RE: meter-mix application

Now I feel unwanted and useless.....☹

**From:** David Gomez  
**Sent:** Tuesday, September 10, 2013 2:04 PM  
**To:** Jonathan Connelly; Richard Bievenue  
**Cc:** David Filbert; Michael R. Leonard; Jonathan Urquhart  
**Subject:** RE: meter-mix application

Hey mang.

No need for Dave and his metering mix systems.

Looks like they only want a 20oz cartridge retainer&cap with spray & needle valve for the pre-mix material and a 6oz cartridge retainer&cap for the solvent ,so it can flush the premixed material out right after doing a batch of boards.

I've done this fluid delivery line several times.

Let me know if you need a project # for reference,Urquhart can also tell you how this is done

Regarding options for spraying two part coatings –we are not there yet.

David E Gomez  
PVA  
Account Executive  
281 217 7247

**From:** Jonathan Connelly  
**Sent:** Tuesday, September 10, 2013 10:10 AM  
**To:** Richard Bievenue  
**Cc:** David Filbert; David Gomez; Michael R. Leonard  
**Subject:** RE: meter-mix application

It is going to be a long time before I could do any real work on a full MMX system for them... unless Dave f wants to work on that part.

I could set them up with a quote for a syringe system for premixed material...

---

**From:** Jonathan Connelly  
**Sent:** Tuesday, September 10, 2013 11:20 AM  
**To:** David Gomez; David Filbert; Richard Bievenue  
**Cc:** Michael R. Leonard; Jonathan Urquhart  
**Subject:** RE: meter-mix application

♪♪ Take a load off Mang! Take a load for free, Take a load off Mang! And (and) (and) you put the load right on me  
(You put the load right on me)! ♪♪

**From:** David Gomez  
**Sent:** Tuesday, September 10, 2013 2:08 PM  
**To:** David Filbert; Jonathan Connelly; Richard Bievenue  
**Cc:** Michael R. Leonard; Jonathan Urquhart  
**Subject:** RE: meter-mix application

Hey mang, Im just taking some load off your back which by the way it's already pretty heavy

David E Gomez  
PVA  
Account Executive  
281 217 7247

**From:** David Filbert  
**Sent:** Tuesday, September 10, 2013 1:05 PM  
**To:** David Gomez; Jonathan Connelly; Richard Bievenue  
**Cc:** Michael R. Leonard; Jonathan Urquhart  
**Subject:** RE: meter-mix application

Now I feel unwanted and useless.....☹

**From:** David Gomez  
**Sent:** Tuesday, September 10, 2013 2:04 PM  
**To:** Jonathan Connelly; Richard Bievenue  
**Cc:** David Filbert; Michael R. Leonard; Jonathan Urquhart  
**Subject:** RE: meter-mix application

Hey mang,

No need for Dave and his metering mix systems.

Looks like they only want a 20oz cartridge retainer&cap with spray & needle valve for the pre-mix material and a 6oz cartridge retainer&cap for the solvent ,so it can flush the premixed material out right after doing a batch of boards.

I've done this fluid delivery line several times.

Let me know if you need a project # for reference,Urquhart can also tell you how this is done

Regarding options for spraying two part coatings –we are not there yet.

David E Gomez  
PVA  
Account Executive  
281 217 7247

**From:** Jonathan Connelly  
**Sent:** Tuesday, September 10, 2013 10:10 AM  
**To:** Richard Bievenue  
**Cc:** David Filbert; David Gomez; Michael R. Leonard  
**Subject:** RE: meter-mix application

It is going to be a long time before I could do any real work on a full MMX system for them... unless Dave f wants to work on that part.

I could set them up with a quote for a syringe system for premixed material...

**From:** Richard Bievenue  
**Sent:** Monday, September 09, 2013 2:12 PM  
**To:** Jonathan Connelly  
**Cc:** David Filbert; David Gomez; Michael R. Leonard  
**Subject:** meter-mix application

Jon,

I just spoke with an engineer from SpaceX named Duc Phan (pronounced "Dook Fawn"). They have one of our 350 machines, s/n W3267. They want to switch to a 2-part material, Huntsman Arathane 5750. They are currently considering just pre-mixing the material and then flushing it out after a couple hours, using a series of valves and solvent tanks. Mike Leonard may be assisting them with getting the electrical schematics and discussing program options with them in case they try to do this on their own.

They would also like to hear what options we have for them as far as a 2-component meter-mix system. Can you contact Duc and let him know you would be the man to pick up the ball on this? Then we can discuss what the best configuration would be.

Contact info:

[Duc.phan@spacex.com](mailto:Duc.phan@spacex.com)  
Ph: 310-363-6316

Best Regards,

Rich Bievenue  
Fluid Systems Engineer





1 Mustang Drive  
Cohoes, NY 12047  
Ph: 518-371-2684 x2203  
[rbievenue@pva.net](mailto:rbievenue@pva.net)

---

**From:** David Gomez  
**Sent:** Wednesday, September 18, 2013 12:41 PM  
**To:** Jonathan Connelly; Richard Bievenue; David Filbert  
**Subject:** RE: Arethane 5750 Automate Rinse and Pruge PVA 350, P/N: SPCX2115 S/N: W3267

Guys,

FYI – this is not the first time we have done this (fluid delivery for a two part coating), I really think we are putting too much resources in this.

REF - project SEAK3101

David E Gomez  
PVA  
Account Executive  
281 217 7247

**From:** Jonathan Connelly  
**Sent:** Wednesday, September 18, 2013 2:17 PM  
**To:** Richard Bievenue; David Filbert  
**Cc:** David Gomez  
**Subject:** RE: Arethane 5750 Automate Rinse and Pruge PVA 350, P/N: SPCX2115 S/N: W3267

Ok let me send my sketch over to Duc and see if he is ok with running two different dilutions out of two different cartridges with a third tank or cartridge for solvent flush.

**From:** Richard Bievenue  
**Sent:** Wednesday, September 18, 2013 2:50 PM  
**To:** Jonathan Connelly; David Filbert  
**Cc:** David Gomez  
**Subject:** RE: Arethane 5750 Automate Rinse and Pruge PVA 350, P/N: SPCX2115 S/N: W3267

I think conceptually that will work, but I would want to minimize the overall number of fittings, eliminate elbows where possible, and optimize the hose/tubing size to keep the volume of mixed material to a minimum and maximize the effectiveness of the solvent flush.

---

**From:** Jonathan Connelly  
**Sent:** Wednesday, September 18, 2013 1:43 PM  
**To:** Richard Bievenue; David Filbert  
**Cc:** David Gomez  
**Subject:** RE: Arethane 5750 Automate Rinse and Pruge PVA 350, P/N: SPCX2115 S/N: W3267

Rich,

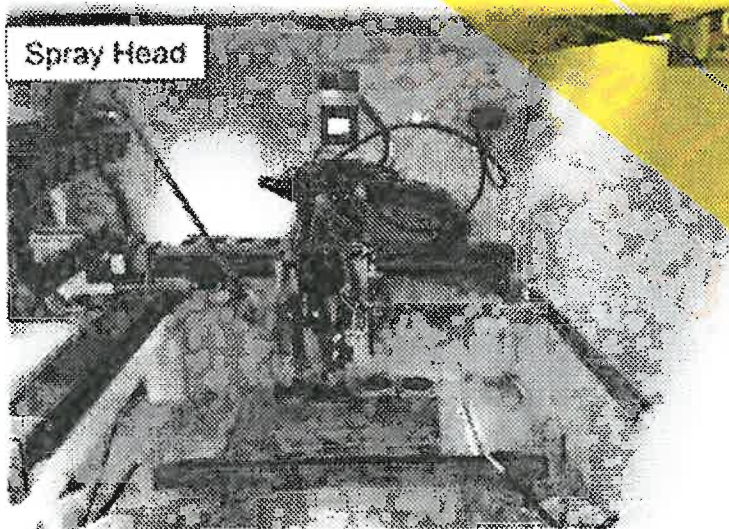
This is what I want to offer Mr. Duc based on this e-mail. See my sketch attached. He should be able to run the diluted mixture with one cartridge and the undiluted mixture with the other then have a tank full of solvent to flush the whole thing out when he wants to..

Let me know what you think..

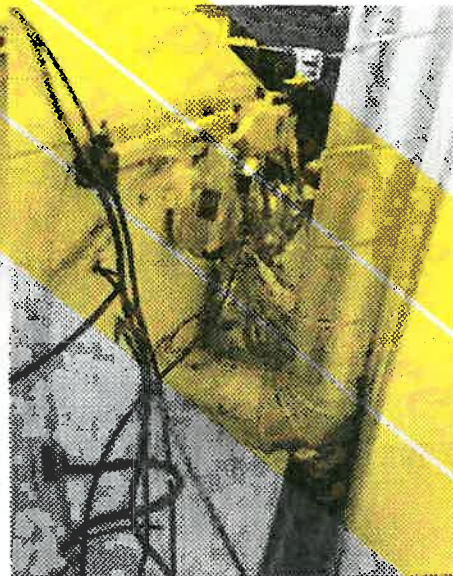
Thanks,

**From:** Duc Phan [<mailto:Duc.Phan@spacex.com>]  
**Sent:** Friday, September 13, 2013 11:20 AM  
**To:** Jonathan Connelly; Michael R. Leonard  
**Cc:** Richard Bievenue; David Filbert  
**Subject:** RE: Arethane 5750 Automate Rinse and Pruge PVA 350, P/N: SPCX2115 S/N: W3267

Hello Jon,  
The current process we removed the hoses from the spray dispensing head and connect the hoses from the Arethane material and Solvent to it. When the Arethane material not in use we caped the Solvent hose and connect the Arethane material hose to the other head just for place holder. The Arethane 5750, part A and part B is mixed together and poured in the first reservoir and the second reservoir is the solvent use to thin out the mixed Arethane for spray requirement.  
If you have three parts metering spray valve please provide a quote also.



Spray Head



Arethane and solvent hoses

Thanks,

Duc Q. Phan  
SpaceX  
Process Engineer  
1 Rocket Road  
Hawthorne, CA 90250  
D PH: 31-363-6316  
C PH: 310-940-9320

**From:** Jonathan Connelly [mailto:JConnelly@PVA.net]  
**Sent:** Friday, September 13, 2013 6:07 AM  
**To:** Duc Phan; Michael R. Leonard  
**Cc:** Richard Bievenue; David Filbert  
**Subject:** RE: Arethane 5750 Automate Rinse and Pruge PVA 350, P/N: SPCX2115 S/N: W3267

Hi Duc,

I have this almost complete. Looking at your pictures. It looks like our drawings do not match what you run on that machine.

**Are you running both the Arethane and the solvent out of the cartridges mounted on the side of the machine?**

Could you send me a picture from the back of the machine where the material connections connect and flow inside the work area?

Thanks,

-Jon

**From:** Duc Phan [mailto:Duc.Phan@spacex.com]  
**Sent:** Thursday, September 12, 2013 11:09 AM  
**To:** Jonathan Connelly; Michael R. Leonard  
**Cc:** Richard Bievenue; David Filbert  
**Subject:** RE: Arethane 5750 Automate Rinse and Pruge PVA 350, P/N: SPCX2115 S/N: W3267

Hello Jon,

I am following up on the quote for the **air actuator valves** and the new program to implement rinse and purge changes.

**We are very exciting to get this Arethane 5750 material automate.**

Thank you,

Duc Q. Phan  
SpaceX  
Process Engineer  
1 Rocket Road  
Hawthorne, CA 90250  
D PH: 31-363-6316  
C PH: 310-940-9320

**From:** Jonathan Connelly [mailto:JConnelly@PVA.net]  
**Sent:** Tuesday, September 10, 2013 8:55 AM  
**To:** Duc Phan; Michael R. Leonard  
**Cc:** Richard Bievenue; David Filbert  
**Subject:** RE: Arethane 5750 Automate Rinse and Pruge PVA 350, P/N: SPCX2115 S/N: W3267

Hi Duc,

I am copying some other people here that you may have talked to or not.



Looking at your request.. We could put pneumatic ball valves to control the material and flush. I think it will waste a good amount of material and solvent. You will need to flush out the material with each rinse cycle and then purge out the solvent until the material starts flowing again...

We could add timers to the machine to stop and alarm every 30 minutes or hour to remind the operators to flush and fill the system..

Do you already have 24 VDC actuator valves that you are planning to use? Why do you need analog control for these? Do you have a data sheet on them?

Best regards,

Jon Connelly  
Technical Sales  
PVA  
1 Mustang Drive  
Cohoes NY, 12047  
Ph# (518) 371-2684 ext 2421  
Cell (518) 487-9611  
Fax (518) 371-2688

**From:** Duc Phan [<mailto:Duc.Phan@spacex.com>]  
**Sent:** Tuesday, September 10, 2013 11:35 AM  
**To:** Michael R. Leonard; Jonathan Connelly  
**Subject:** Arethane 5750 Automate Rinse and Pruge PVA 350, P/N: SPCX2115 S/N: W3267

Hello John,

I am a Process engineer for SpaceX located in Hawthorne, CA. We have the PVA 350, P/N: SPCX2115 S/N: W3267. We are using the Arethane 5750 material that have 2 hours cure time, which we are concern that operator may forgot to purge and rinse the material when the job is done. To avoid this problem I am hoping to automate the purge and rinse process. The plan is to have the 24VDC actuator valves to turn on/off the purge and rinse reservoirs after the coating program.

I need help writing the subroutine program for rinse and purge and identify which analog signals can I connect the 24VDC actuator valves and the which digital signals to turn them on?

Thank you in-advance for helping!

Duc Q. Phan  
SpaceX  
Process Engineer  
1 Rocket Road  
Hawthorne, CA 90250  
D PH: 31-363-6316  
C PH: 310-940-9320

**From:** Michael R. Leonard [<mailto:MLeonard@PVA.net>]  
**Sent:** Monday, September 09, 2013 10:53 AM  
**To:** Duc Phan  
**Subject:** schematic

Duc,

Here is the electrical schematic for your machine. Also here is Jon Connelly's information. [jconnelly@pva.net](mailto:jconnelly@pva.net) and his number is (518)371-2684 ext 2421.

Thanks,  
Mike

**From:** David Gomez  
**Sent:** Wednesday, September 18, 2013 1:05 PM  
**To:** Richard Bievenue  
**Cc:** Jonathan Connelly  
**Subject:** RE: Arethane 5750 Automate Rinse and Pruge PVA 350, P/N: SPCX2115 S/N: W3267



David E Gomez  
PVA  
Account Executive  
281 217 7247

**From:** Richard Bievenue  
**Sent:** Wednesday, September 18, 2013 2:50 PM  
**To:** David Gomez  
**Cc:** Jonathan Connelly  
**Subject:** RE: Arethane 5750 Automate Rinse and Pruge PVA 350, P/N: SPCX2115 S/N: W3267

Connelly ain't got shit to do anyway Mang.

**From:** David Gomez  
**Sent:** Wednesday, September 18, 2013 3:48 PM  
**To:** Jonathan Connelly; Richard Bievenue; David Filbert  
**Subject:** RE: Arethane 5750 Automate Rinse and Pruge PVA 350, P/N: SPCX2115 S/N: W3267



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**From:** Jonathan Connelly  
**Sent:** Wednesday, September 25, 2013 9:02 AM  
**To:** Craig Tuttle; Ed Borzon; Jason McCreary; Jeffrey Van Norden; Jeremy Prusky; Rex Ellis; Rodrigo Gutierrez  
**Subject:** RE: New one Space X  
**Attachments:** Sales Order-SPCX2115 rework 9-25-2013.pdf



## SALES ORDER FORM

Date: 9/25/2013

PVA Sales: Connelly Sales Rep: -

Company Name: Space X

Contact Name: Duc Phan Email: Duc.Phan@spacex.com

Phone: 31-363-6316 Fax: -

PVA Job #: SPCX2115 W3267

Work Order#: W3267R1 PO #: 258364

Project Start Date: 9/25/2013 Terms: 100% net 30

Quoted Delivery: 6 weeks ARO

Ship Date Commit: They need this before week of Oct 21st

### DELIVERY

PVA Arranged Shipment: -

Customer Arranged Shipment: X

Shipping Company: -

### Scope:

Mechanical

Electrical

Programming

Fluid Delivery

On-site support

### SALES ORDER ADDITIONS:

PO Hardcopy: X

Spare Parts PO: -

Application Form: -

Quotation: X

Other Communications: X

List all machine options or special requirements that are not included in the quotation:

Rework the dispense system to add (1) one gallon tank and pneumatic ball valve for automatic solvent flush by number of cycles or can be started from cycle stop. Number of cycles needs to be variable.

Ref: B72-01433

Under Six Weeks Craig: \_\_\_\_\_

Date: \_\_\_\_\_

Tony/Jayson Authorization: \_\_\_\_\_

Date: \_\_\_\_\_

#3747

Trade Secrets: Proprietary costs and pricing

CONFIDENTIAL



# QUOTATION

DATE  
9/19/2013

QUOTATION NUMBER  
131909W3267

1 Mustang Drive Cohoes NY, 12047

Tel 518 371 2684 ext 2421

Fax 518 371 2686

JConnelly@pva.net

www.pva.net

TO:

Duc Q. Phan  
SpaceX  
1 Rocket Road  
Hawthorne, CA 90250

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QTY	MODEL	DESCRIPTION	Price/ ea	Extended
1	B72-01433	Rework the dispense system on machine serial number W3267 to connect one cartridge to (1) one gallon tank for automatic solvent flush of Arethane 5705. <ul style="list-style-type: none"> <li>Includes all hoses and fittings needed for complete integration.</li> <li>Includes one pneumatic ball valve for automatic solvent flush.</li> <li>Includes hardware and software needed for integration.</li> <li>Includes new one gallon tank.</li> </ul>	\$4,175.00	\$4,175.00
1	ON-SITE	On-site from PVA to travel o Space X and install the new auto solvent flush system. <ul style="list-style-type: none"> <li>Labor rate based on 8-10 hour work day Monday through Friday non-US holiday.</li> </ul>	\$1,150.00	\$1,150.00
1	Expenses	Estimate of the direct travel expenses to travel from Cohoes NY to Hawthorne CA for one full day on-site. <ul style="list-style-type: none"> <li>Expenses to include but not limited to airfare, lodging, ground transportation and meals.</li> <li>Estimate can be used as a not to exceed limit.</li> </ul>	\$1,750.00	\$1,750.00

Total: \$7,075.00

TERMS	DELIVERY	SHIPMENT	WARRANTY
100% Net 30	6 weeks ARO	FOB PVA Factory Cohoes NY USA, + crating charge of up to \$500 (if applicable)	1 Year on all parts and labor Excluding soft seals.

## ORDER CANCELLATION POLICY

Buyer may only cancel the order for equipment in writing with a cancel charge as per the following schedule:

Cancellation Notice Received  
0-30 days from order date  
31-60 days from order date  
More than 60 days from order date

Cancellation Fee Multiplier  
25%  
35%  
70%

#3748



## PURCHASE ORDER

Trade Secrets: Proprietary costs and pricing

Page 1 of 2

APPROVED

CONFIDENTIAL

## Bill To:

Space Exploration Technologies  
1 Rocket Road  
Hawthorne, CA 90250  
Phone: (310)363-6000 Fax: (310)363-6001

PO Number:

258364

Revision Number:

0

Order Date:

9/24/2013

## Issued To:

PVA - Precision Valve &amp; Automation, Inc

1 Mustang Dr  
Cohoes, NY 12047 US

Phone: 518.371.2684 Fax: 518.371.2688

Contact:

Email:

## Ship To:

Space Exploration Technologies

1 Rocket Road  
Hawthorne, CA 90250  
UNITED STATES

## Buyer Information:

Buyer: Andrea Jarrett

Email: Andrea.Jarrett@spacex.com

Phone: (310) 970-8381

Terms	Supplier ID	Tax Terms	F.O.B.	Shipping Method	Status
50% IN ADVANCE, 30% AT SHIPPING, 20% NET 30	PVAINC	Taxable	Destination	Bestway	Released

Line	Qty	UM	Part ID / Mfg Part ID	Supplier Part ID	Service ID	Current Promise Date	Original Promise Date	Need Date	Unit Price	Total
1	1.00	EA		B72-01433		11/7/13	11/7/13	11/7/13	\$ 4,175.0000	\$ 4,175.00

Description

Rework the dispense system on machine serial number W3267 to connect one cartridge to (1) one gallon tank for automatic solvent flush of Arethane 5750.

- Includes all hoses and fittings needed for complete integration.
- Includes one pneumatic ball valve for automatic solvent flush.
- Includes hardware and software needed for integration.
- Includes new one gallon tank.

Line	Qty	UM	Part ID / Mfg Part ID	Supplier Part ID	Service ID	Current Promise Date	Original Promise Date	Need Date	Unit Price	Total
2	1.00	EA		ON-SITE		11/7/13	11/7/13	11/7/13	\$ 1,150.0000	\$ 1,150.00

Description

On-site from PVA to travel o Space X and install the new auto solvent flush system.  
-Labor rate based on 8-10 hour work day Monday through Friday non-US holiday.

Line	Qty	UM	Part ID / Mfg Part ID	Supplier Part ID	Service ID	Current Promise Date	Original Promise Date	Need Date	Unit Price	Total
3	1.00	EA		Expenses		11/7/13	11/7/13	11/7/13	\$ 1,750.0000	\$ 1,750.00

**PURCHASE ORDER**  
**APPROVED**

Page 2 of 2

**Bill To:**

Space Exploration Technologies  
1 Rocket Road  
Hawthorne, CA 90250  
Phone: (310)363-6000 Fax: (310)363-6001

**PO Number:****258364****Revision Number:**

0

**Order Date:**

9/24/2013

**Issued To:**

PVA - Precision Valve & Automation, Inc  
1 Mustang Dr  
Cohoes, NY 12047 US  
Phone: 518.371 2684 Fax: 518.371 2688  
Contact:  
Email:

**Ship To:**

Space Exploration Technologies  
1 Rocket Road  
Hawthorne, CA 90250  
UNITED STATES

**Buyer Information:**

Buyer: Andrea Jarrett  
Email: Andrea.Jarrett@spacex.com  
Phone: (310) 970-8381

Terms	Supplier ID	Tax Terms	F.O.B.	Shipping Method	Status
50% IN ADVANCE, 30% AT SHIPPING, 20% NET 30	PVAINC	Taxable	Destination	Bestway	Released

**Description**

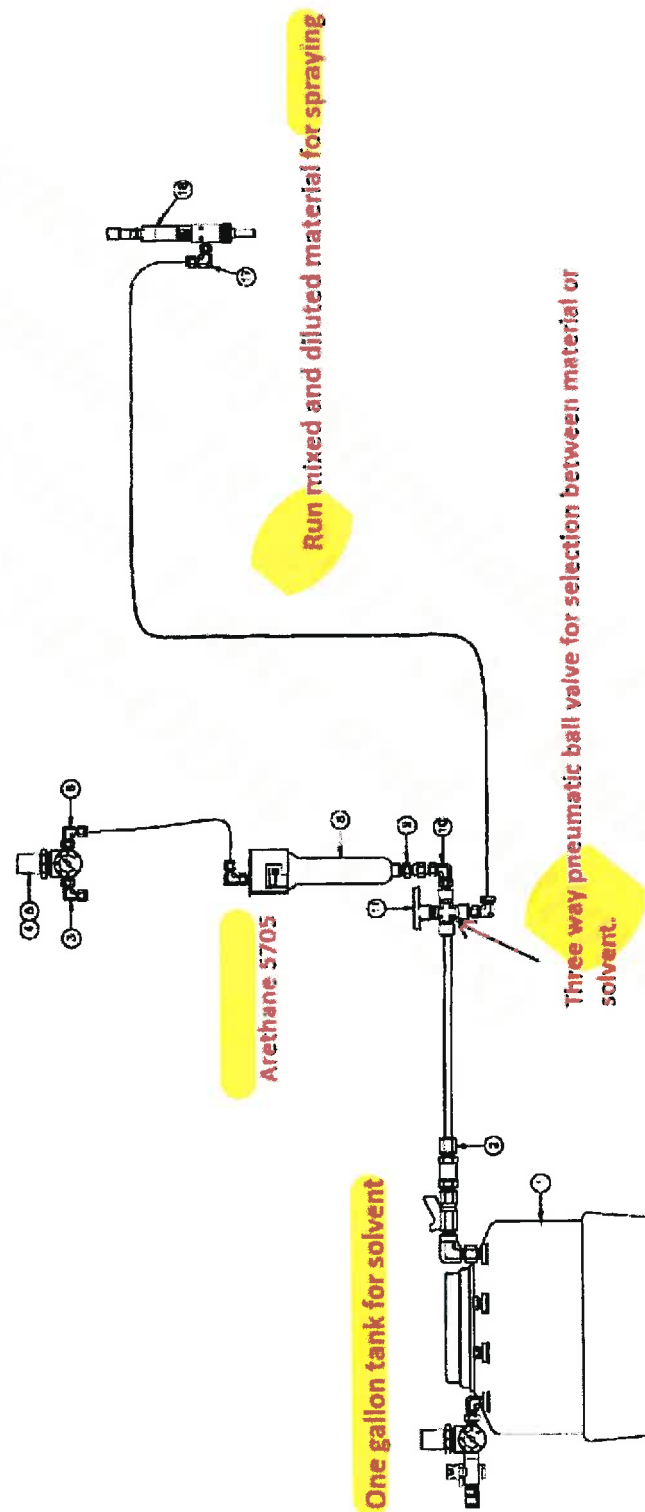
Estimate of the direct travel expenses to travel from Cohoes NY to Hawthorne CA for one full day on-site.  
- Expenses to include but not limited to airfare, lodging, ground transportation and meals.  
- Estimate is a not to exceed limit.

**ORDER TOTAL: \$7,075.00****Order Specifications**

Reference PVA quotation # 131909W3267

*Please include PO number on all shipping information and invoices.  
Please submit all invoices to [accountspayable@spacex.com](mailto:accountspayable@spacex.com)*

**Terms and Conditions.** Commencing with this order signifies supplier's acceptance of this P.O. and its agreement with all SpaceX Terms and Conditions, any applicable SpaceX Quality Clauses, and any applicable Federal Acquisition Regulations (FAR). The SpaceX Terms and Conditions, applicable Quality Clauses and applicable FAR and FAR Supplement clauses are incorporated by reference. The SpaceX Terms and Conditions, applicable Quality Clauses, and applicable FAR and FAR Supplement clauses may be viewed at the following link: <http://www.spacex.com/legal>



## PVA

## BILL OF MATERIAL

B72-01433

ISSUE DATE	10/8/13	PART/ASSEMBLY: SPCX2115/W3267R2	SHEET	1	of	1
REV. DATE			REVISION			A

ITEM	DESCRIPTION	PART NUMBER	QTY	UNIT	ECN#	REMARKS
				Ref		
1	One gallon pressure tank assembly	B62-2719	1	Ea		Alloy. 163-2204
2	Fitting: 3/8fnpt x -06mpt. SS	6-6 GTX-SS	1	Ea		
3	Urethane coated S braided Teflon hose assembly: -06 x 8ft	B62-2365	1	Ea		Includes two 10691N-6-6C hose ends
4	Fitting: 1/4mnpt x -06mpt 90. SS	6-6 CTX-SS	1	Ea		
5	Ball valve: 1/4fnpt. 3 way pneumatically operated	SS-43GXF4-51D	1	Ea		
6	Air fitting: 1/8mnpt x 1/4tube 90	KQ2L07-34S	2	Ea		
7	Fitting: 1/4mnpt x 1/4tube 90	4MSEL4N-316	2	Ea		
8	Teflon material tubing: black. 1/4od x 10ft	TFETB01S70250B	3	Ea		Trim as needed
9	Fitting: 1/4mnpt x 1/4tube	4MSC4N-316	1	Ea		
10	Material cartridge: hose clamp	5388K16	1	Ea		
11	Fitting: 1/4tube x 1/4tube bulkhead	4BC4-316	1	Ea		
12	Fitting: 1/8mnpt x 1/4tube 90	4MSEL2N-316	1	Ea		
13	Air tubing: red. 1/4od x 15ft	TU0604R	1	Ea		Trim as needed. not shown
14	Air tubing: blue. 1/4od x 15ft	TU0604BU	1	Ea		Trim as needed. not shown
15				Ea		
16				Ea		
17				Ea		
18				Ea		
19				Ea		
20				Ea		
22				Ea		
23				Ea		
24				Ea		
25				Ea		PVA-1746



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**From:** Ted St. Marie  
**Sent:** Monday, October 14, 2013 1:34 PM  
**To:** Mark Kniese; Rex Ellis; Rodrigo Gutierrez  
**Cc:** Kyle Crane; Jonathan Connelly; Mark Kniese; Jamie Blender  
**Subject:** RE: SPCX2115 W3267R2  
**Attachments:** W3267R2.xls

Mark,

Here's what I have for this pneumatic, adding the pneumatic ball valve for the auto solvent flush to the 7<sup>th</sup> manifold station with a 2-position solenoid.

All other dispense, pneumatic schematics & documentation are completed in the project rework folders.

Thanks,

Ted

**From:** Ted St. Marie  
**Sent:** Monday, October 14, 2013 1:08 PM  
**To:** Kyle Crane; Jeffrey Van Norden  
**Cc:** Jonathan Connelly; Mark Kniese; Jamie Blender  
**Subject:** RE: SPCX2115 W3267R2

Kyle,

I just got this back and I'm finishing up on it now, I'll let you know when I'm done.

Thanks,

Ted

**From:** Kyle Crane  
**Sent:** Monday, October 14, 2013 10:57 AM  
**To:** Jeffrey Van Norden  
**Cc:** Jonathan Connelly; Mark Kniese; Jamie Blender; Ted St. Marie  
**Subject:** RE: SPCX2115 W3267R2

Jeff,

Is the pneumatic BOM going to be updated for the pneumatic ball valve or is that not going to be controlled by the manifold?

Best Regards,  
Kyle Crane



Production-Reworks



: (518) 371-2684 Ext: 2433



: [KCrane@pva.net](mailto:KCrane@pva.net)

**From:** Ted St. Marie  
**Sent:** Monday, October 14, 2013 10:50 AM  
**To:** Kyle Crane  
**Cc:** Jeffrey Van Norden; Jonathan Connelly; Mark Kniese; Jamie Blender  
**Subject:** RE: SPCX2115 W3267R2

I no longer have that paperwork, I'm guessing that project was reassigned when I was out last week?

Thanks,

Ted

**From:** Kyle Crane  
**Sent:** Monday, October 14, 2013 10:46 AM  
**To:** Ted St. Marie  
**Subject:** SPCX2115 W3267R2

Is SPCX fully updated?

Best Regards,  
Kyle Crane



Production-Reworks



: (518) 371-2684 Ext: 2433



: [KCrane@pva.net](mailto:KCrane@pva.net)

	A	B	C	D	E	F	G	H	I	J	K	L
1												
2	B32-0149R2											
3	MACHINE 2300											
4	8 STATION											
5	Station											
6	1	Z-SLIDE	DOWN	950	UP	951						
7	2	ATOM	ON	952	PLUG	954	953	2POSS	VLV1	53	25	
8	3	VALVE	OPEN	955	CLOSE	958		2POSS	VLV1		26	
9	4	Z-SLIDE	DOWN	957	UP	958					27	
10	5	ROTARY	45DEG	959	ODEG	960		2POSS	VLV2	54	28	
11	6	VALVE	OPEN	961	CLOSE	962		2POSS	VLV2	55,56	29,30	
12	7	BALL VALVE	OPEN	963	CLOSE	964		2POSS	VLV2		31	
13	8	SPARE	*****	965	*****	965		BLANK			32	
14												
15												
16	Rules for Sensor		Sensor				VALVE LAYOUT					
17	Input #		Number				VLV1	VLV2				
18							FCS100.E5	FC100				
19	Low Level (mat.)		49									
20	PIP (Conveyor)		50,51,52									
21	Pneumatic		53+				FRONT					
22	PIP (Fixture)		Next				TO	RIGHT				
23	SPARE		65,66,67				PIP LAYOUT					
24	Needle Cal.		61,62,63				PIP #1	PIP #2				
25	Needle Cal. in place		64				50	51				
26	Low Exhaust Flow		71				FRONT	52				

---

**From:** Ted St. Marie  
**Sent:** Wednesday, October 16, 2013 8:56 AM  
**To:** Rex Ellis; Jonathan Connelly; Michael R. Leonard; Kyle Crane  
**Cc:** Mark Kniese; Wendy Wen; David Lesperence; Randall Allen; Jeffrey Van Norden  
**Subject:** RE: SPCX2115 W3267R2 rework

I guess I'm not familiar enough with pneumatic ball valves to justify this.  
Can anyone else suggest how the solenoid outputs should be assigned to the ball valve on an automatic solvent flush?

Thanks,

Ted

**From:** Rex Ellis  
**Sent:** Wednesday, October 16, 2013 11:49 AM  
**To:** Ted St. Marie; Jonathan Connelly; Michael R. Leonard; Kyle Crane  
**Cc:** Mark Kniese; Wendy Wen  
**Subject:** RE: SPCX2115 W3267R2 rework

Ted,  
Is #32 open to the solvent or open to the material?  
Rex

**From:** Ted St. Marie  
**Sent:** Wednesday, October 16, 2013 11:42 AM  
**To:** Rex Ellis; Jonathan Connelly; Michael R. Leonard; Kyle Crane  
**Cc:** Mark Kniese; Wendy Wen  
**Subject:** RE: SPCX2115 W3267R2 rework

I listed the following on the pneumatics for the ball valve,

Solenoid outputs:  
#32 open  
#33 closed

Wendy – did you show the same in the electrical?

**From:** Rex Ellis  
**Sent:** Wednesday, October 16, 2013 11:33 AM  
**To:** Ted St. Marie; Jonathan Connelly; Michael R. Leonard; Kyle Crane  
**Cc:** Mark Kniese; Wendy Wen  
**Subject:** RE: SPCX2115 W3267R2 rework

Wendy/Ted,  
Which position of the solenoid is opening the ball valve to solvent?  
Rex

**From:** Ted St. Marie  
**Sent:** Wednesday, October 16, 2013 10:53 AM  
**To:** Jonathan Connelly; Rex Ellis; Michael R. Leonard; Kyle Crane  
**Cc:** Mark Kniese; Wendy Wen  
**Subject:** RE: SPCX2115 W3267R2 rework

Wendy has updated the electrical for the pneumatic ball valve to be controlled by a 3-position solenoid for the auto solvent flush.

Thanks,

Ted

**From:** Wendy Wen  
**Sent:** Wednesday, October 16, 2013 10:47 AM  
**To:** Ted St. Marie  
**Subject:** SPCX2115

Hi Ted,

I have updated the electrical Schematic 123-2435R2, and the Bom B72-01433. It is all set on electrical end.

Thanks,  
Wendy

---

**From:** Jonathan Connelly  
**Sent:** Wednesday, October 23, 2013 9:20 AM  
**To:** Rex Ellis  
**Subject:** FW: Release of Purchase Order 258364 Space X

**From:** Duc Phan [mailto:Duc.Phan@spacex.com]  
**Sent:** Wednesday, October 23, 2013 12:07 PM  
**To:** Jonathan Connelly  
**Cc:** Rodrigo Gutierrez; David Filbert; Michael R. Leonard  
**Subject:** RE: Release of Purchase Order 258364

Hello John and Michael,

Thank you for your great service of installing the automatic flush system. Few bugs to work out.

1. In automatic mode the spray valve is not dropping down.
2. In rinse location we need to drop the valve down to make it the same as auto rinse and flush.

Thank you,

Duc Q. Phan  
SpaceX  
Process Engineer  
1 Rocket Road  
Hawthorne, CA 90250  
D PH: 31-363-6316  
C PH: 310-940-9320

**From:** Jonathan Connelly [mailto:JConnelly@PVA.net]  
**Sent:** Thursday, October 17, 2013 12:13 PM  
**To:** Duc Phan  
**Cc:** Rodrigo Gutierrez; David Filbert; Michael R. Leonard  
**Subject:** RE: Release of Purchase Order 258364

Hi Duc,

The parts are leaving today via Fed Ex standard overnight tracking number 558400575653 can you please confirm to me when you receive them tomorrow?

Mike Leonard has arrangements made to fly out Monday and be at your facility Tuesday the 22<sup>nd</sup>.

Anything else please feel free to ask.

Best regards,

Jon Connelly  
Technical Sales  
PVA  
1 Mustang Drive

Cohoes NY, 12047  
Ph# (518) 371-2684 ext 2421  
Cell (518) 487-9611  
Fax (518) 371-2688

**From:** Duc Phan [<mailto:Duc.Phan@spacex.com>]  
**Sent:** Wednesday, October 16, 2013 5:34 PM  
**To:** Jonathan Connelly  
**Cc:** Rodrigo Gutierrez; David Filbert  
**Subject:** RE: Release of Purchase Order 258364

Hello Jonathan and Rodrigo,  
Please let me know your arrive schedule for next week Oct. 21<sup>st</sup>.  
Also what do I need to do to prepare for your onsite work?

Thanks,

Duc Q. Phan  
SpaceX  
Process Engineer  
1 Rocket Road  
Hawthorne, CA 90250  
D PH: 31-363-6316  
C PH: 310-940-9320

**From:** Jonathan Connelly [<mailto:JConnelly@PVA.net>]  
**Sent:** Tuesday, October 08, 2013 8:05 AM  
**To:** Duc Phan  
**Cc:** Rodrigo Gutierrez; David Filbert  
**Subject:** RE: Release of Purchase Order 258364

Thanks Duc,

Attached is a picture of the new dispense system we are planning to build you.

Let me know if this looks ok to you and I will work on getting these out to your asap.

We have you penciled in for service the week of the 21<sup>st</sup> for the service trip. Let us know which day is best for you that week.

Best regards,

Jon Connelly  
Technical Sales  
PVA  
1 Mustang Drive  
Cohoes NY, 12047  
Ph# (518) 371-2684 ext 2421  
Cell (518) 487-9611  
Fax (518) 371-2688



**From:** Duc Phan [<mailto:Duc.Phan@spacex.com>]  
**Sent:** Tuesday, October 08, 2013 10:55 AM  
**To:** Jonathan Connelly  
**Subject:** RE: Release of Purchase Order 258364

Please see below.

FedEx Accounts for Hawthorne:  
Small parcel and air freight account #: 251204527  
Main freight account #: 414707149

Thanks,

Duc Q. Phan  
SpaceX  
Process Engineer  
1 Rocket Road  
Hawthorne, CA 90250  
D PH: 31-363-6316  
C PH: 310-940-9320

**From:** Jonathan Connelly [<mailto:JConnelly@PVA.net>]  
**Sent:** Monday, October 07, 2013 8:15 AM  
**To:** Duc Phan  
**Subject:** RE: Release of Purchase Order 258364

Hi Duc,

Give me a call today when you get a chance? The status of your current order is dependent on what you want to with the 2<sup>nd</sup> material.

Thanks,

-Jon

**From:** Duc Phan [<mailto:Duc.Phan@spacex.com>]  
**Sent:** Wednesday, October 02, 2013 11:42 AM  
**To:** Jonathan Connelly  
**Subject:** RE: Release of Purchase Order 258364

Hello Jonathan,

I am waiting to talk with my manager but as for the original plan must stay on schedule for October 21 because I am reserve the from production that day.

I will call you this afternoon for sure.

Thanks

Duc Q. Phan  
SpaceX  
Process Engineer  
1 Rocket Road  
Hawthorne, CA 90250  
D PH: 31-363-6316  
C PH: 310-940-9320

**From:** Jonathan Connelly [<mailto:JConnelly@PVA.net>]  
**Sent:** Wednesday, October 02, 2013 8:39 AM  
**To:** Duc Phan  
**Subject:** RE: Release of Purchase Order 258364

Hi Duc,

I'm not sure where we left off with this.

Can you give me a call later this afternoon to discuss?

Thanks and best regards,

Jon Connelly  
Technical Sales  
PVA  
1 Mustang Drive  
Cohoes NY, 12047  
Ph# (518) 371-2684 ext 2421  
Cell (518) 487-9611  
Fax (518) 371-2688

**From:** Duc Phan [<mailto:Duc.Phan@spacex.com>]  
**Sent:** Thursday, September 26, 2013 3:02 PM  
**To:** Jonathan Connelly; warpdrive  
**Cc:** Rodrigo Gutierrez  
**Subject:** RE: Release of Purchase Order 258364

Hello Jonathan and Rod,  
We are interest in having second pneumatic valve adding to the existing changes.  
Please give me a call to go over the program and control.  
Thanks,

Duc Q. Phan  
SpaceX  
Process Engineer  
1 Rocket Road  
Hawthorne, CA 90250  
D PH: 31-363-6316  
C PH: 310-940-9320

**From:** Jonathan Connelly [<mailto:JConnelly@PVA.net>]  
**Sent:** Wednesday, September 25, 2013 8:50 AM  
**To:** Duc Phan; warpdrive  
**Cc:** Rodrigo Gutierrez  
**Subject:** RE: Release of Purchase Order 258364

Hi Duc,

Rod has you penciled in for a day of support on the week of the 21st.

You can work with Rod to get a specific day confirmed.

Best regards,

Jon Connelly  
Technical Sales  
PVA  
1 Mustang Drive  
Cohoes NY, 12047  
Ph# (518) 371-2684 ext 2421  
Cell (518) 487-9611  
Fax (518) 371-2688

---

**From:** Duc Phan [<mailto:Duc.Phan@spacex.com>]  
**Sent:** Wednesday, September 25, 2013 11:26 AM  
**To:** Jonathan Connelly; warpdrive  
**Subject:** RE: Release of Purchase Order 258364

Hello Jonathan,  
Per our conversation the sooner the better.  
On reserve Oct. 21-25 any one of these date will be fine.

Thanks,

Duc Q. Phan  
SpaceX  
Process Engineer  
1 Rocket Road  
Hawthorne, CA 90250  
D PH: 31-363-6316  
C PH: 310-940-9320

---

**From:** Jonathan Connelly [<mailto:JConnelly@PVA.net>]  
**Sent:** Wednesday, September 25, 2013 5:12 AM  
**To:** warpdrive  
**Cc:** Duc Phan  
**Subject:** RE: Release of Purchase Order 258364

Thanks Guys,

We will get started on this.

Duc,

Do you have a date that would be good for the on-site support to integrate this?

Best regards,

Jon Connelly  
Technical Sales  
PVA  
1 Mustang Drive  
Cohoes NY, 12047  
Ph# (518) 371-2684 ext 2421  
Cell (518) 487-9611  
Fax (518) 371-2688

**From:** Warp Drive [<mailto:warpdrive@spacex.com>]  
**Sent:** Tuesday, September 24, 2013 7:57 PM  
**To:** Jonathan Connelly  
**Cc:** [Duc.Phan@spacex.com](mailto:Duc.Phan@spacex.com)  
**Subject:** Release of Purchase Order 258364

Attached please find approved purchase order 258364. Please acknowledge receipt of Purchase Order by sending an email to Andrea Jarrett at [Andrea.Jarrett@spacex.com](mailto:Andrea.Jarrett@spacex.com). This message was automatically generated; Please contact the Buyer if the order requires any further clarification at the address mentioned above.

---

**From:** Jonathan Connelly  
**Sent:** Tuesday, July 22, 2014 8:22 AM  
**To:** Gavin Matupang  
**Subject:** FW: Release of Purchase Order 258364 Space X

Hi Gavin,

Duc is going to be looking for a quote on a new machine. He has some boards that are 30" x 18" he would need a huge oversized machine to do this in one step. Or he could index the part on conveyors.

Maybe you can get in touch with him to work on the new machine quote. I am helping him with this thing.

Thanks,

-Jon

**From:** Duc Phan [mailto:Duc.Phan@spacex.com]  
**Sent:** Monday, July 21, 2014 6:48 PM  
**To:** Rex Ellis; Jonathan Connelly; David Filbert; Michael R. Leonard  
**Subject:** RE: Release of Purchase Order 258364 Space X

Hello Rex,

PVA350

S/N: W3267

P/N: SPCX2115

Our current machine configuration is to use two materials ( Humiseal and Arathane) We have one spray valve for both material. Each material have it's own pressure container that control by different solenoid valve, when we use the teach pendant purge button only the Humiseal material activate. We need this teach pendant purge button to work for both material by selecting material from main menu.

Thank you,  
Duc Q. Phan  
SpaceX  
Process Engineer  
1 Rocket Road  
Hawthorne, CA 90250  
D PH: 310-363-6316  
C PH: 310-940-9320

**From:** Rex Ellis [mailto:REllis@PVA.net]  
**Sent:** Wednesday, October 23, 2013 10:10 AM  
**To:** Jonathan Connelly; Duc Phan; David Filbert; Michael R. Leonard  
**Subject:** RE: Release of Purchase Order 258364 Space X

Duc,

I've attached an updated main program (3267\_M07.txt) that will drop the valves down when doing the flush and refill.

Let me know if you run into any issues or need assistance in downloading the program.

Thanks,

**Rex Ellis**



**Production Programming Manager**  
1 Mustang Drive  
Cohoes, NY 12047  
**Phone:** (518) 371-2684 EXT 2305  
**Cell:** (518) 466-8044  
**<http://www.pva.net>**

**From:** Jonathan Connelly  
**Sent:** Wednesday, October 23, 2013 12:20 PM  
**To:** Rex Ellis  
**Subject:** FW: Release of Purchase Order 258364 Space X

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**To:** Jonathan Connelly  
**Cc:** Rodrigo Gutierrez; David Filbert; Michael R. Leonard  
**Subject:** RE: Release of Purchase Order 258364

Hello John and Michael,

Thank you for your great service of installing the automatic flush system. Few bugs to work out.

1. In automatic mode the spray valve is not dropping down.
2. In rinse location we need to drop the valve down to make it the same as auto rinse and flush.

Thank you,

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Process Engineer  
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**Sent:** Thursday, October 17, 2013 12:13 PM  
**To:** Duc Phan  
**Cc:** Rodrigo Gutierrez; David Filbert; Michael R. Leonard  
**Subject:** RE: Release of Purchase Order 258364

Hi Duc,

The parts are leaving today via Fed Ex standard overnight tracking number 558400575653 can you please confirm to me when you receive them tomorrow?

Mike Leonard has arrangements made to fly out Monday and be at your facility Tuesday the 22<sup>nd</sup>.

Anything else please feel free to ask.

Best regards,

Jon Connelly  
Technical Sales  
PVA  
1 Mustang Drive  
Cohoes NY, 12047  
Ph# (518) 371-2684 ext 2421  
Cell (518) 487-9611  
Fax (518) 371-2688

**From:** Duc Phan [<mailto:Duc.Phan@spacex.com>]  
**Sent:** Wednesday, October 16, 2013 5:34 PM  
**To:** Jonathan Connelly  
**Cc:** Rodrigo Gutierrez; David Filbert  
**Subject:** RE: Release of Purchase Order 258364

Hello Jonathan and Rodrigo,  
Please let me know your arrive schedule for next week Oct. 21<sup>st</sup>.  
Also what do I need to do to **prepare for your onsite** work?

Thanks,

Duc Q. Phan  
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Process Engineer  
1 Rocket Road  
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D PH: 31-363-6316  
C PH: 310-940-9320

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**Cc:** Rodrigo Gutierrez; David Filbert  
**Subject:** RE: Release of Purchase Order 258364

Thanks Duc,

Attached is a picture of the new dispense system we are planning to build you.

Let me know if this looks ok to you and I will work on getting these out to your asap.



We have you penciled in for service the week of the 21st for the service trip. Let us know which day is best for you that week.

Best regards,

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FedEx Accounts for Hawthorne:  
Small parcel and air freight account #: 251204527  
Main freight account #: 414707149

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Process Engineer  
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C PH: 310-940-9320

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**From:** Duc Phan [<mailto:Duc.Phan@spacex.com>]  
**Sent:** Thursday, September 26, 2013 3:02 PM

**To:** Jonathan Connelly; warpdrive  
**Cc:** Rodrigo Gutierrez  
**Subject:** RE: Release of Purchase Order 258364

Hello Jonathan and Rod,  
We are interest in having second **pneumatic valve adding to the existing changes.**  
Please give me a call to go over the program and control.  
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Process Engineer  
1 Rocket Road  
Hawthorne, CA 90250  
D PH: 31-363-6316  
C PH: 310-940-9320

**From:** Jonathan Connelly [<mailto:JConnelly@PVA.net>]  
**Sent:** Wednesday, September 25, 2013 8:50 AM  
**To:** Duc Phan; warpdrive  
**Cc:** Rodrigo Gutierrez  
**Subject:** RE: Release of Purchase Order 258364

Hi Duc,

Rod has you penciled in for a day of support on the week of the 21st.

You can work with Rod to get a specific day confirmed.

Best regards,

Jon Connelly  
Technical Sales  
PVA  
1 Mustang Drive  
Cohoes NY, 12047  
Ph# (518) 371-2684 ext 2421  
Cell (518) 487-9611  
Fax (518) 371-2688

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**Sent:** Wednesday, September 25, 2013 11:26 AM  
**To:** Jonathan Connelly; warpdrive  
**Subject:** RE: Release of Purchase Order 258364

Hello Jonathan,  
Per our conversation the sooner the better.  
On reserve Oct. 21-25 any one of these date will be fine.

Thanks,

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Process Engineer  
1 Rocket Road  
Hawthorne, CA 90250  
D PH: 31-363-6316  
C PH: 310-940-9320

**From:** Jonathan Connelly [<mailto:JConnelly@PVA.net>]  
**Sent:** Wednesday, September 25, 2013 5:12 AM  
**To:** warpdrive  
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**Subject:** RE: Release of Purchase Order 258364

Thanks Guys,

We will get started on this.

Duc,

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Best regards,

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Technical Sales  
PVA  
1 Mustang Drive  
Cohoes NY, 12047  
Ph# (518) 371-2684 ext 2421  
Cell (518) 487-9611  
Fax (518) 371-2688

**From:** Warp Drive [<mailto:warpdrive@spacex.com>]  
**Sent:** Tuesday, September 24, 2013 7:57 PM  
**To:** Jonathan Connelly  
**Cc:** [Duc.Phan@spacex.com](mailto:Duc.Phan@spacex.com)  
**Subject:** Release of Purchase Order 258364

Attached please find approved purchase order 258364. Please acknowledge receipt of Purchase Order by sending an email to Andrea Jarrett at [Andrea.Jarrett@spacex.com](mailto:Andrea.Jarrett@spacex.com). This message was automatically generated; Please contact the Buyer if the order requires any further clarification at the address mentioned above.

Trade Secrets: Proprietary costs and pricing

CONFIDENTIAL

---

**From:** Jonathan Connelly  
**Sent:** Tuesday, July 22, 2014 2:28 PM  
**To:** Stephanie King  
**Cc:** Justin Potyrala  
**Subject:** RE: RFQ 43777

Hi Stephanie,

Part number **FCS3-ES-SP** are in stock at \$350.00 each.

**From:** Stephanie King [mailto:Stephanie.King@spacex.com]  
**Sent:** Tuesday, July 22, 2014 4:20 PM  
**To:** Jonathan Connelly  
**Subject:** RFQ 43777

Good afternoon,

I'm looking for the following Part Numbers:

FCS300-es - **PVA FCS3-ES-SP FCS300-ES SPARE PARTS KIT**  
Qty: 2ea

Thank you,

**SPACEX**

**Stephanie King**  
**Purchasing Coordinator**

Space Exploration Technologies Corporation  
12651 Crenshaw Blvd., Hawthorne, CA 90250  
w:310.219.7994  
[www.spacex.com](http://www.spacex.com)

Mission highlights: <http://youtu.be/QwDCWTqNceQ> Turn the sound up!

**Please note:** This email message, including any attachments, contains or may contain confidential information intended only for the addressee. If you are not an intended recipient of this message, be advised that any reading, dissemination, forwarding, printing, copying, or other use of this message or its attachments is strictly prohibited. Moreover, this email may contain technical data as defined in the International Traffic in Arms Regulations (ITAR) and re-export or transfer of this information to a third party or foreign entity requires the approval of SpaceX and the U.S. Department of State prior to export, transport, or re-export.

---

**From:** Gavin Matupang  
**Sent:** Monday, November 17, 2014 6:31 AM  
**To:** Jonathan Urquhart  
**Subject:** Re: SpaceX visit and lab trials

Ok

Regards,

Gavin Matupang  
Precision Valve & Automation  
Regional Sales Manager  
Cell: (612) 720-1441  
[www.pva.net](http://www.pva.net)

Sent via iPhone

On Nov 17, 2014, at 8:30 AM, "Jonathan Urquhart" <[JUrquhart@PVA.net](mailto:JUrquhart@PVA.net)> wrote:

Maybe 2<sup>nd</sup> week of December.

Do they want to mix and spray on the fly with the 5750? I know Asymtek is pushing that lately. Also, an older email mentions dispensing a Bergquist out of a 400ml bi-pack? Just want to make sure I don't miss one of the apps.

Let me give you a call later before we commit.

Thanks,  
Jon

**From:** Gavin Matupang  
**Sent:** Monday, November 17, 2014 8:13 AM  
**To:** Jonathan Urquhart  
**Subject:** SpaceX visit and lab trials

Jon,

What does the first couple of weeks of December look like for SpaceX. Probably need two days. Let me know. I will come out for this one. Scott from SpaceX visited Asymtek already. Need to blow them away with PVA.

Regards,

Gavin Matupang  
<[image001.jpg](#)>  
Regional Sales Manager  
1 Mustang Drive,  
Cohoes, NY 12047  
Cell: (612) 720-1441

---

**From:** Scott Vorhies <Scott.Vorhies@spacex.com>  
**Sent:** Monday, November 17, 2014 8:15 AM  
**To:** Gavin Matupang  
**Cc:** Cory Jacobs  
**Subject:** RE: Dispensing equipment

Gavin,

Let me know when you confirm the available dates. The Bergquist material is a future need that can be looked into later but there are some other materials I wish to review. When I get the data available I will send it along. Also for the Arathane I would like to look at both possibilities since I have yet to see anyone consistently dispense and mix this material.

**From:** Gavin Matupang [<mailto:gmatupang@PVA.net>]  
**Sent:** Monday, November 17, 2014 6:50 AM  
**To:** Scott Vorhies  
**Cc:** Cory Jacobs  
**Subject:** FW: Dispensing equipment

Scott,

Let me confirm with factory for availability. Right now it looks good for the second week of December.

What about the Bergquist material you inquired about dispensing? Do you need to include it in the mix?

Also, with Arathane, do you want to continue to pre-mix and spray or would you like to see a mix on demand option?

Regards,

Gavin Matupang



Regional Sales Manager  
1 Mustang Drive,  
Cohoes, NY 12047  
Cell: (612) 720-1441  
[gmatupang@pva.net](mailto:gmatupang@pva.net)  
[www.pva.net](http://www.pva.net)

**From:** Cory Jacobs [<mailto:cjrestronics@gmail.com>]  
**Sent:** Friday, November 14, 2014 4:58 PM  
**To:** Gavin Matupang  
**Subject:** Fwd: Dispensing equipment

Looks like i caught him just in time for the Dispensing equipment.....



---

**From:** Frank Hart  
**Sent:** Monday, December 01, 2014 12:31 PM  
**To:** Gavin Matupang  
**Subject:** RE: Next week

Sounds good. See you then.

**Frank Hart**

**PVA**

Sales and Marketing Manager  
One Mustang Drive  
Cohoes, NY 12047  
**Phone:** (518) 371-2684 EXT 2101  
**Cell:** (518) 225-2203  
<http://www.pva.net>  
[fhart@pva.net](mailto:fhart@pva.net)

**From:** Gavin Matupang  
**Sent:** Monday, December 01, 2014 3:27 PM  
**To:** Frank Hart  
**Subject:** Next week

Frank,

I will be at PVA next week. Scott Vorhies from SpaceX is visiting to perform a number of trials for a couple of days (Tues & Wed). I have also scheduled Larry Aderman's son, LaPa Ent in Nocal, for a training visit. Nick Aderman will be in on Wed. He is moving out to Ca to join the business in 2015. He is currently in Philly.

My schedule is Tuesday-Thursday at PVA. See you next week.

My schedule

Regards,

**Gavin Matupang**



Regional Sales Manager  
1 Mustang Drive,  
Cohoes, NY 12047  
**Cell:** (612) 720-1441  
[gmatupang@pva.net](mailto:gmatupang@pva.net)  
[www.pva.net](http://www.pva.net)

---

**From:** Jonathan Urquhart  
**Sent:** Tuesday, December 02, 2014 9:03 AM  
**To:** Gavin Matupang  
**Subject:** RE: spacex

Ok.

I'll split it up into 2 types of demos then:

- Coating with the Arathane 2-part mix and spray.
- SMT type dispensing using a 650 or Delta 6 with board heat, JDX (underfill), SVX (paste), FC100 (solder mask)

Sound about right?

**From:** Gavin Matupang  
**Sent:** Tuesday, December 02, 2014 11:59 AM  
**To:** Jonathan Urquhart  
**Subject:** Re: spacex

Yup.

Regards,

Gavin Matupang  
Precision Valve & Automation  
Regional Sales Manager  
Cell: (612) 720-1441  
[www.pva.net](http://www.pva.net)

Sent via iPhone

On Dec 2, 2014, at 10:58 AM, Jonathan Urquhart <[JUrquhart@PVA.net](mailto:JUrquhart@PVA.net)> wrote:

Ah OK. Confirmed for 9<sup>th</sup>-10<sup>th</sup> then (Tues-Wed)?

**From:** Gavin Matupang  
**Sent:** Tuesday, December 02, 2014 11:56 AM  
**To:** Jonathan Urquhart  
**Subject:** Re: spacex

9th and 10th.

Regards,

Gavin Matupang  
Precision Valve & Automation  
Regional Sales Manager

---

**From:** Gavin Matupang  
**Sent:** Saturday, December 06, 2014 7:49 AM  
**To:** Jonathan Urquhart  
**Subject:** Re: SpaceX

Yeah. Last time I visited SpaceX, they were masking more than they should. They are only spraying using 3 axis now.

Regards,

Gavin Matupang  
Precision Valve & Automation  
Regional Sales Manager  
Cell: (612) 720-1441  
[www.pva.net](http://www.pva.net)

Sent via iPhone

> On Dec 6, 2014, at 9:46 AM, Jonathan Urquhart <[JUrquhart@PVA.net](mailto:JUrquhart@PVA.net)> wrote:  
>  
> A question on the coating demo portion, we will have a mix on the fly demo setup to just spray on our 3 axis oversize in the lab but would it also make sense to demo a 4 axis Delta 6 and premix the coating?  
>  
> Jon Urquhart  
> Director - Global Applications Engineering PVA  
> 518-371-2684 x2275

---

**From:** David DiDomenico <David.DiDomenico@spacex.com>  
**Sent:** Tuesday, December 23, 2014 10:28 AM  
**To:** Matt Lilla  
**Subject:** RE: Battery Dispense questions

Nice, I figured you'd seen this before. The applications I'm interested in are:

- Using this super-fast curing latex mask in place of this material we currently use (the pink stuff we brought with us). It cures in 5 mins at ambient.
- Using a highly-catalyzed version of Arathane 5750, that would cure in a few mins at 65C. This doesn't exist yet but basically I would just get our vendor to jack up the catalyst level. This probably wouldn't be too difficult to dispense, as it would still take some time to set up at ambient, but way quicker than the 90 mins it takes now. I can probably have them whip up a batch to test.

Thanks,

**David DiDomenico | Manufacturing Engineer, Avionics**

**SPACE**

1 Rocket Rd, Hawthorne CA 90250  
Office: 310-970-3467  
Mobile: 850-544-5767

-- This Email Contains Sensitive Proprietary and Confidential Information - Not for Further Distribution Without the Express Written Consent of Space Exploration Technologies --

**From:** Matt Lilla [mailto:MLilla@PVA.net]  
**Sent:** Tuesday, December 23, 2014 4:47 AM  
**To:** David DiDomenico  
**Subject:** RE: Battery Dispense questions

Hi David,

Yes it is possible and like you said there would be purging going on to keep the system "fresh" or you will have to make sure that your consistently running parts.

Some 2 part materials have a tack time of 3 minutes that we have run, key is to watch pressure feedback from the transducers along with purging to normalize the system. There has been a big market for this lately so I've been doing quite a bit of testing with 2 part spraying, a lot of it just depends on the material. If you can give me some info on the material I could take it up with my boss and see what he thinks as well.

Thanks,  
Matthew Lilla  
Applications Engineer  
1 Mustang Drive  
Cohoes, NY 12047  
Ph. 518-371-2684 Ext.2813  
[mlilla@pva.net](mailto:mlilla@pva.net)

---

**From:** David Gomez  
**Sent:** Tuesday, September 10, 2013 11:04 AM  
**To:** Jonathan Connelly; Richard Bievenue  
**Cc:** David Filbert; Michael R. Leonard; Jonathan Urquhart  
**Subject:** RE: meter-mix application

Hey mang,

No need for Dave and his metering mix systems.

Looks like they only want a 20oz cartridge retainer&cap with spray & needle valve for the pre-mix material and a 6oz cartridge retainer&cap for the solvent ,so it can flush the premixed material out right after doing a batch of boards.

I've done this fluid delivery line several times.

Let me know if you need a project # for reference,Urquhart can also tell you how this is done

Regarding options for spraying two part coatings --we are not there yet.

David E Gomez  
PVA  
Account Executive  
281 217 7247

**From:** Jonathan Connelly  
**Sent:** Tuesday, September 10, 2013 10:10 AM  
**To:** Richard Bievenue  
**Cc:** David Filbert; David Gomez; Michael R. Leonard  
**Subject:** RE: meter-mix application

It is going to be a long time before I could do any real work on a full MMX system for them... unless Dave f wants to work on that part.

I could set them up with a quote for a syringe system for premixed material...

**From:** Richard Bievenue  
**Sent:** Monday, September 09, 2013 2:12 PM  
**To:** Jonathan Connelly  
**Cc:** David Filbert; David Gomez; Michael R. Leonard  
**Subject:** meter-mix application

Jon,

I just spoke with an engineer from SpaceX named Duc Phan (pronounced "Dook Fawn"). They have one of our 350 machines, s/n W3267. They want to switch to a 2-part material, Huntsman Arathane 5750. They are currently considering just pre-mixing the material and then flushing it out after a couple hours, using a series of valves and solvent tanks. Mike Leonard may be assisting them with getting the electrical schematics and discussing program options with them in case they try to do this on their own.

They would also like to hear what options we have for them as far as a 2-component meter-mix system. Can you contact Duc and let him know you would be the man to pick up the ball on this? Then we can discuss what the best configuration would be.

Contact info:

[Duc.phan@spacex.com](mailto:Duc.phan@spacex.com)

Ph: 310-363-6316

Best Regards,

Rich Bievenue  
Fluid Systems Engineer



1 Mustang Drive  
Cohoes, NY 12047  
Ph: 518-371-2684 x2203  
[rbievenue@pva.net](mailto:rbievenue@pva.net)

---

**From:** Jonathan Connelly  
**Sent:** Tuesday, September 10, 2013 11:20 AM  
**To:** David Gomez; David Filbert; Richard Bievenue  
**Cc:** Michael R. Leonard; Jonathan Urquhart  
**Subject:** RE: meter-mix application

♪♪ Take a load off Mang! Take a load for free, Take a load off Mang! And (and) (and) you put the load right on me (You put the load right on me)! ♪♪

**From:** David Gomez  
**Sent:** Tuesday, September 10, 2013 2:08 PM  
**To:** David Filbert; Jonathan Connelly; Richard Bievenue  
**Cc:** Michael R. Leonard; Jonathan Urquhart  
**Subject:** RE: meter-mix application

Hey mang, Im just taking some load off your back which by the way it's already pretty heavy

David E Gomez  
PVA  
Account Executive  
281 217 7247

**From:** David Filbert  
**Sent:** Tuesday, September 10, 2013 1:05 PM  
**To:** David Gomez; Jonathan Connelly; Richard Bievenue  
**Cc:** Michael R. Leonard; Jonathan Urquhart  
**Subject:** RE: meter-mix application

Now I feel unwanted and useless.....☹

**From:** David Gomez  
**Sent:** Tuesday, September 10, 2013 2:04 PM  
**To:** Jonathan Connelly; Richard Bievenue  
**Cc:** David Filbert; Michael R. Leonard; Jonathan Urquhart  
**Subject:** RE: meter-mix application

Hey mang,

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David E Gomez  
PVA  
Account Executive  
281 217 7247

**From:** Jonathan Connelly  
**Sent:** Tuesday, September 10, 2013 10:10 AM  
**To:** Richard Bievenue  
**Cc:** David Filbert; David Gomez; Michael R. Leonard  
**Subject:** RE: meter-mix application

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I could set them up with a quote for a syringe system for premixed material...

**From:** Richard Bievenue  
**Sent:** Monday, September 09, 2013 2:12 PM  
**To:** Jonathan Connelly  
**Cc:** David Filbert; David Gomez; Michael R. Leonard  
**Subject:** meter-mix application

Jon,

I just spoke with an engineer from SpaceX named Duc Phan (pronounced "Dook Fawn"). They have one of our 350 machines, s/n W3267. They want to switch to a 2-part material, Huntsman Arathane 5750. They are currently considering just pre-mixing the material and then flushing it out after a couple hours, using a series of valves and solvent tanks. Mike Leonard may be assisting them with getting the electrical schematics and discussing program options with them in case they try to do this on their own.

They would also like to hear what options we have for them as far as a 2-component meter-mix system. Can you contact Duc and let him know you would be the man to pick up the ball on this? Then we can discuss what the best configuration would be.

Contact info:

[Duc.phan@spacex.com](mailto:Duc.phan@spacex.com)  
Ph: 310-363-6316

Best Regards,

Rich Bievenue  
Fluid Systems Engineer



1 Mustang Drive  
Cohoes, NY 12047  
Ph: 518-371-2684 x2203  
[rbievenue@pva.net](mailto:rbievenue@pva.net)

---

**From:** David Gomez  
**Sent:** Wednesday, September 18, 2013 12:41 PM  
**To:** Jonathan Connelly; Richard Bievenue; David Filbert  
**Subject:** RE: Arethane 5750 Automate Rinse and Pruge PVA 350, P/N: SPCX2115 S/N: W3267

Guys,

FYI – this is not the first time we have done this (fluid delivery for a two part coating), I really think we are putting too much resources in this.

REF - project SEAK3101

David E Gomez  
PVA  
Account Executive  
281 217 7247

**From:** Jonathan Connelly  
**Sent:** Wednesday, September 18, 2013 2:17 PM  
**To:** Richard Bievenue; David Filbert  
**Cc:** David Gomez  
**Subject:** RE: Arethane 5750 Automate Rinse and Pruge PVA 350, P/N: SPCX2115 S/N: W3267

Ok let me send my sketch over to Duc and see if he is ok with running two different dilutions out of two different cartridges with a third tank or cartridge for solvent flush..

**From:** Richard Bievenue  
**Sent:** Wednesday, September 18, 2013 2:50 PM  
**To:** Jonathan Connelly; David Filbert  
**Cc:** David Gomez  
**Subject:** RE: Arethane 5750 Automate Rinse and Pruge PVA 350, P/N: SPCX2115 S/N: W3267

I think conceptually that will work, but I would want to minimize the overall number of fittings, eliminate elbows where possible, and optimize the hose/tubing size to keep the volume of mixed material to a minimum and maximize the effectiveness of the solvent flush.

---

**From:** Jonathan Connelly  
**Sent:** Wednesday, September 18, 2013 1:43 PM  
**To:** Richard Bievenue; David Filbert  
**Cc:** David Gomez  
**Subject:** RE: Arethane 5750 Automate Rinse and Pruge PVA 350, P/N: SPCX2115 S/N: W3267

Rich,

This is what I want to offer Mr. Duc based on this e-mail. See my sketch attached. He should be able to run the diluted mixture with one cartridge and the undiluted mixture with the other then have a tank full of solvent to flush the whole thing out when he wants to..

Let me know what you think..

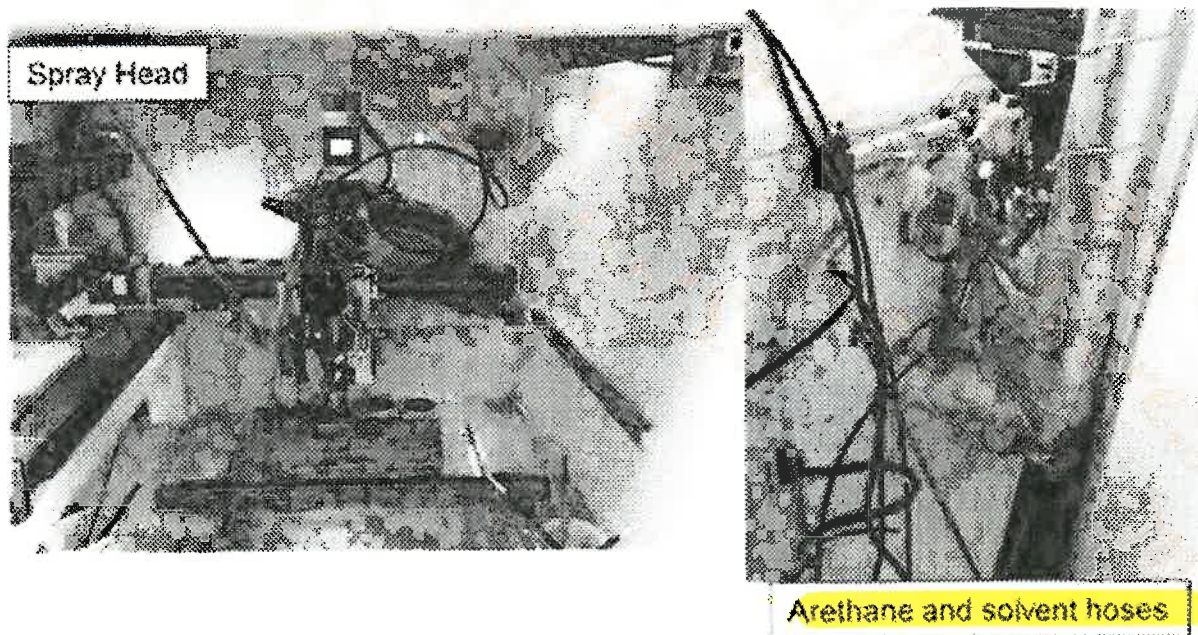
Thanks,

**From:** Duc Phan [<mailto:Duc.Phan@spacex.com>]  
**Sent:** Friday, September 13, 2013 11:20 AM  
**To:** Jonathan Connelly; Michael R. Leonard  
**Cc:** Richard Bievenue; David Filbert  
**Subject:** RE: Arethane 5750 Automate Rinse and Pruge PVA 350, P/N: SPCX2115 S/N: W3267

Hello Jon,

The current process we removed the hoses from the spray dispensing head and connect the hoses from the Arethane material and Solvent to it. When the Arethane material not in use we caped the Solvent hose and connect the Arethane material hose to the other head just for place holder. The Arethane 5750, part A and part B is mixed together and poured in the first reservoir and the second reservoir is the solvent use to thin out the mixed Arethane for spray requirement.

If you have three parts metering spray valve please provide a quote also.



Thanks,

Duc Q. Phan  
SpaceX  
Process Engineer  
1 Rocket Road  
Hawthorne, CA 90250  
D PH: 31-363-6316  
C PH: 310-940-9320

**From:** Jonathan Connelly [mailto:JConnelly@PVA.net]  
**Sent:** Friday, September 13, 2013 6:07 AM  
**To:** Duc Phan; Michael R. Leonard  
**Cc:** Richard Bievenue; David Filbert  
**Subject:** RE: Arethane 5750 Automate Rinse and Pruge PVA 350, P/N: SPCX2115 S/N: W3267

Hi Duc,

I have this almost complete. Looking at your pictures. It looks like our drawings do not match what you run on that machine.

Are you running both the Arethane and the solvent out of the cartridges mounted on the side of the machine?

Could you send me a picture from the back of the machine where the material connections connect and flow inside the work area?

Thanks,

-Jon

**From:** Duc Phan [mailto:Duc.Phan@spacex.com]  
**Sent:** Thursday, September 12, 2013 11:09 AM  
**To:** Jonathan Connelly; Michael R. Leonard  
**Cc:** Richard Bievenue; David Filbert  
**Subject:** RE: Arethane 5750 Automate Rinse and Pruge PVA 350, P/N: SPCX2115 S/N: W3267

Hello Jon,

I am following up on the quote for the air actuator valves and the new program to implement rinse and purge changes. We are very exciting to get this Arethane 5750 material automate.

Thank you,

Duc Q. Phan  
SpaceX  
Process Engineer  
1 Rocket Road  
Hawthorne, CA 90250  
D PH: 31-363-6316  
C PH: 310-940-9320

**From:** Jonathan Connelly [mailto:JConnelly@PVA.net]  
**Sent:** Tuesday, September 10, 2013 8:55 AM  
**To:** Duc Phan; Michael R. Leonard  
**Cc:** Richard Bievenue; David Filbert  
**Subject:** RE: Arethane 5750 Automate Rinse and Pruge PVA 350, P/N: SPCX2115 S/N: W3267

Hi Duc,

I am copying some other people here that you may have talked to or not.



Looking at your request.. We could put pneumatic ball valves to control the material and flush. I think it will waste a good amount of material and solvent. You will need to flush out the material with each rinse cycle and then purge out the solvent until the material starts flowing again...

We could add timers to the machine to stop and alarm every 30 minutes or hour to remind the operators to flush and fill the system..

Do you already have 24 VDC actuator valves that you are planning to use? Why do you need analog control for these? Do you have a data sheet on them?

Best regards,

Jon Connelly  
Technical Sales  
PVA  
1 Mustang Drive  
Cohoes NY, 12047  
Ph# (518) 371-2684 ext 2421  
Cell (518) 487-9611  
Fax (518) 371-2688

**From:** Duc Phan [<mailto:Duc.Phan@spacex.com>]  
**Sent:** Tuesday, September 10, 2013 11:35 AM  
**To:** Michael R. Leonard; Jonathan Connelly  
**Subject:** Arethane 5750 Automate Rinse and Pruge PVA 350, P/N: SPCX2115 S/N: W3267

Hello John,  
I am a Process engineer for SpaceX located in Hawthorne, CA. We have the PVA 350, P/N: SPCX2115 S/N: W3267. We are using the Arethane 5750 material that have 2 hours cure time, which we are concern that operator may forgot to purge and rinse the material when the job is done. To avoid this problem I am hoping to automate the purge and rinse process. The plan is to have the 24VDC actuator valves to turn on/off the purge and rinse reservoirs after the coating program.

I need help writing the subroutine program for rinse and purge and identify which analog signals can I connect the 24VDC actuator valves and the which digital signals to turn them on?

Thank you in-advance for helping!

Duc Q. Phan  
SpaceX  
Process Engineer  
1 Rocket Road  
Hawthorne, CA 90250  
D PH: 31-363-6316  
C PH: 310-940-9320

**From:** Michael R. Leonard [<mailto:MLeonard@PVA.net>]  
**Sent:** Monday, September 09, 2013 10:53 AM  
**To:** Duc Phan  
**Subject:** schematic

Duc,

Here is the electrical schematic for your machine. Also here is Jon Connelly's information. [jconnelly@pva.net](mailto:jconnelly@pva.net) and his number is (518)371-2684 ext 2421.

Thanks,  
Mike



**PVA****BILL OF MATERIAL****B72-01433**

<b>ISSUE DATE</b> 10/8/13	<b>PART/ASSEMBLY:</b> SPCX2115/ W3267R2	<b>SHEET</b> 1 of 1	
		<b>REVISION</b> A	

ITEM	DESCRIPTION	PART NUMBER	QTY	UNIT	ECN#	REMARKS
1	One gallon pressure tank assembly	B62-2719	1	Ea		Alloy, 163-2204
2	Fitting: 3/8fnt x -06mjic, SS	6-6 GTX-SS	1	Ea		
3	Urethane coated S braided Teflon hose assembly: -06 x 8ft	B62-2365	1	Ea		Includes two 1069 1N-6-6C hose ends
4	Fitting: 1/4mnp x -06mjic 90, SS	6-6 CTX-SS	1	Ea		
5	Ball valve: 1/4fnt, 3 way, pneumatically operated	SS-43GXF4-51D	1	Ea		
6	Air fitting: 1/8mnp x 1/4tube 90	KQ2L07-34S	2	Ea		
7	Fitting: 1/4mnp x 1/4tube 90	4MSEL4N-316	2	Ea		
8	Teflon material tubing black, 1/4od x 10ft	TFETB01870250B	3	Ea		Trim as needed
9	Fitting: 1/4mnp x 1/4tube	4MSC4N-316	1	Ea		
10	Material cartridge, hose clamp	5388K16	1	Ea		
11	Fitting: 1/4tube x 1/4tube bulkhead	4BC4-316	1	Ea		
12	Fitting: 1/8mnp x 1/4tube 90	4MSEL2N-316	1	Ea		
13	Air tubing: red, 1/4od x 15ft	TU0604R	1	Ea		Trim as needed, not shown
14	Air tubing: blue, 1/4od x 15ft	TU0604BU	1	Ea		Trim as needed, not shown
15				Ea		
16				Ea		
17				Ea		
18				Ea		
19				Ea		
20				Ea		
22				Ea		
23				Ea		
24				Ea		
25				Ea		PVA-1746

268

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**From:** Ted St. Marie  
**Sent:** Monday, October 14, 2013 1:34 PM  
**To:** Mark Kniese; Rex Ellis; Rodrigo Gutierrez  
**Cc:** Kyle Crane; Jonathan Connelly; Mark Kniese; Jamie Blender  
**Subject:** RE: SPCX2115 W3267R2  
**Attachments:** W3267R2.xls

Mark,

Here's what I have for this pneumatic, adding the pneumatic ball valve for the auto solvent flush to the 7<sup>th</sup> manifold station with a 2-position solenoid.

All other dispense, pneumatic schematics & documentation are completed in the project rework folders.

Thanks,

Ted

**From:** Ted St. Marie  
**Sent:** Monday, October 14, 2013 1:08 PM  
**To:** Kyle Crane; Jeffrey Van Norden  
**Cc:** Jonathan Connelly; Mark Kniese; Jamie Blender  
**Subject:** RE: SPCX2115 W3267R2

Kyle,

I just got this back and I'm finishing up on it now, I'll let you know when I'm done.

Thanks,

Ted

**From:** Kyle Crane  
**Sent:** Monday, October 14, 2013 10:57 AM  
**To:** Jeffrey Van Norden  
**Cc:** Jonathan Connelly; Mark Kniese; Jamie Blender; Ted St. Marie  
**Subject:** RE: SPCX2115 W3267R2

Jeff,

Is the pneumatic BOM going to be updated for the pneumatic ball valve or is that not going to be controlled by the manifold?

Best Regards,  
Kyle Crane



Production-Reworks



: (518) 371-2684 Ext: 2433



: [KCrane@pva.net](mailto:KCrane@pva.net)

**From:** Ted St. Marie  
**Sent:** Monday, October 14, 2013 10:50 AM  
**To:** Kyle Crane  
**Cc:** Jeffrey Van Norden; Jonathan Connelly; Mark Kniese; Jamie Blender  
**Subject:** RE: SPCX2115 W3267R2

I no longer have that paperwork, I'm guessing that project was reassigned when I was out last week?

Thanks,

Ted

**From:** Kyle Crane  
**Sent:** Monday, October 14, 2013 10:46 AM  
**To:** Ted St. Marie  
**Subject:** SPCX2115 W3267R2

Is SPCX fully updated?

Best Regards,  
Kyle Crane



Production-Reworks



: (518) 371-2684 Ext: 2433



: [KCrane@pva.net](mailto:KCrane@pva.net)

	A	B	C	D	E	F	G	H	I	J	K	L
1												
2	B32-0149R2											
3	MACHINE 2300											
4	8 STATION											
5	Station											
6	1	Z-SLIDE	A-port Function DOWN	A-port Label 950	B-port Function UP	B-port Label 951	Regulator Label 953	Solenoid Type 2POSS	Head Pos. VLV1	Sensor Number 53	Output Number 25	
7	2	ATOM	ON	952	PLUG	954	953	2POSS	VLV1	53	25	
8	3	VALVE	OPEN	955	CLOSE	956		2POSS	VLV1		27	
9	4	Z-SLIDE	DOWN	957	UP	958		2POSS	VLV2	54	28	
10	5	ROTARY	45DEG	959	0DEG	960		3POSS	VLV2	55,56	29,30	
11	6	VALVE	OPEN	961	CLOSE	962		2POSS	VLV2		31	
12	7	BALL VALVE	OPEN	963	CLOSE	964		2POSS	VLV2		32	
13	8	SPARE	*****	965	*****	966		BLANK				
14												
15												
16		Rules for Sensor	Sensor				VALVE LAYOUT					
17		Input #	Number				VLV1	VLV2				
18							FCS100-ES	FC100				
19		Low Level (mat.)	49									
20		PIP (Conveyor)	50,51,52									
21		Pneumatic	53+				FRONT					
22		Pip (Fixture)	Next				TO	RIGHT				
23		SPARE	65,66,67				PIP LAYOUT					
24		Needle Cal.	61,62,63				PIP #1	PIP #2				
25		Needle Cal. in place	64				50	51				
26		Low Exhaust Flow	71				FRONT					

---

**From:** Ted St. Marie  
**Sent:** Wednesday, October 16, 2013 8:56 AM  
**To:** Rex Ellis; Jonathan Connelly; Michael R. Leonard; Kyle Crane  
**Cc:** Mark Kniese; Wendy Wen; David Lesperence; Randall Allen; Jeffrey Van Norden  
**Subject:** RE: SPCX2115 W3267R2 rework

I guess I'm not familiar enough with pneumatic ball valves to justify this.  
Can anyone else suggest how the solenoid outputs should be assigned to the ball valve on an automatic solvent flush?

Thanks,

Ted

**From:** Rex Ellis  
**Sent:** Wednesday, October 16, 2013 11:49 AM  
**To:** Ted St. Marie; Jonathan Connelly; Michael R. Leonard; Kyle Crane  
**Cc:** Mark Kniese; Wendy Wen  
**Subject:** RE: SPCX2115 W3267R2 rework

Ted,

Is #32 open to the solvent or open to the material?

Rex

**From:** Ted St. Marie  
**Sent:** Wednesday, October 16, 2013 11:42 AM  
**To:** Rex Ellis; Jonathan Connelly; Michael R. Leonard; Kyle Crane  
**Cc:** Mark Kniese; Wendy Wen  
**Subject:** RE: SPCX2115 W3267R2 rework

I listed the following on the pneumatics for the ball valve,

Solenoid outputs:

#32 open

#33 closed

Wendy – did you show the same in the electrical?

**From:** Rex Ellis  
**Sent:** Wednesday, October 16, 2013 11:33 AM  
**To:** Ted St. Marie; Jonathan Connelly; Michael R. Leonard; Kyle Crane  
**Cc:** Mark Kniese; Wendy Wen  
**Subject:** RE: SPCX2115 W3267R2 rework

Wendy/Ted,

Which position of the solenoid is opening the ball valve to solvent?

Rex

**From:** Ted St. Marie  
**Sent:** Wednesday, October 16, 2013 10:53 AM  
**To:** Jonathan Connelly; Rex Ellis; Michael R. Leonard; Kyle Crane  
**Cc:** Mark Kniese; Wendy Wen  
**Subject:** RE: SPCX2115 W3267R2 rework

Wendy has updated the electrical for the pneumatic ball valve to be controlled by a 3-position solenoid for the auto solvent flush.

Thanks,

Ted

**From:** Wendy Wen  
**Sent:** Wednesday, October 16, 2013 10:47 AM  
**To:** Ted St. Marie  
**Subject:** SPCX2115

Hi Ted,

I have updated the electrical Schematic 123-2435R2, and the Bom B72-01433. It is all set on electrical end.

Thanks,  
Wendy

---

**From:** Jonathan Connelly  
**Sent:** Wednesday, October 23, 2013 9:20 AM  
**To:** Rex Ellis  
**Subject:** FW: Release of Purchase Order 258364 Space X

**From:** Duc Phan [mailto:Duc.Phan@spacex.com]  
**Sent:** Wednesday, October 23, 2013 12:07 PM  
**To:** Jonathan Connelly  
**Cc:** Rodrigo Gutierrez; David Filbert; Michael R. Leonard  
**Subject:** RE: Release of Purchase Order 258364

Hello John and Michael,

Thank you for your great service of installing the automatic flush system. Few bugs to work out.

1. In automatic mode the spray valve is not dropping down.
2. In rinse location we need to drop the valve down to make it the same as auto rinse and flush.

Thank you,

Duc Q. Phan  
SpaceX  
Process Engineer  
1 Rocket Road  
Hawthorne, CA 90250  
D PH: 31-363-6316  
C PH: 310-940-9320

**From:** Jonathan Connelly [mailto:JConnelly@PVA.net]  
**Sent:** Thursday, October 17, 2013 12:13 PM  
**To:** Duc Phan  
**Cc:** Rodrigo Gutierrez; David Filbert; Michael R. Leonard  
**Subject:** RE: Release of Purchase Order 258364

Hi Duc,

The parts are leaving today via Fed Ex standard overnight tracking number 558400575653 can you please confirm to me when you receive them tomorrow?

Mike Leonard has arrangements made to fly out Monday and be at your facility Tuesday the 22<sup>nd</sup>.

Anything else please feel free to ask.

Best regards,

Jon Connelly  
Technical Sales  
PVA  
1 Mustang Drive



Cohoes NY, 12047  
Ph# (518) 371-2684 ext 2421  
Cell (518) 487-9611  
Fax (518) 371-2688

**From:** Duc Phan [<mailto:Duc.Phan@spacex.com>]  
**Sent:** Wednesday, October 16, 2013 5:34 PM  
**To:** Jonathan Connelly  
**Cc:** Rodrigo Gutierrez; David Filbert  
**Subject:** RE: Release of Purchase Order 258364

Hello Jonathan and Rodrigo,  
Please let me know your arrive schedule for next week Oct. 21<sup>st</sup>.  
Also what do I need to do to prepare for your onsite work?

Thanks,

Duc Q. Phan  
SpaceX  
Process Engineer  
1 Rocket Road  
Hawthorne, CA 90250  
D PH: 31-363-6316  
C PH: 310-940-9320

**From:** Jonathan Connelly [<mailto:JConnelly@PVA.net>]  
**Sent:** Tuesday, October 08, 2013 8:05 AM  
**To:** Duc Phan  
**Cc:** Rodrigo Gutierrez; David Filbert  
**Subject:** RE: Release of Purchase Order 258364

Thanks Duc,

Attached is a picture of the new dispense system we are planning to build you.

Let me know if this looks ok to you and I will work on getting these out to your asap.

We have you penciled in for service the week of the 21<sup>st</sup> for the service trip. Let us know which day is best for you that week.

Best regards,

Jon Connelly  
Technical Sales  
PVA  
1 Mustang Drive  
Cohoes NY, 12047  
Ph# (518) 371-2684 ext 2421  
Cell (518) 487-9611  
Fax (518) 371-2688

**From:** Duc Phan [<mailto:Duc.Phan@spacex.com>]  
**Sent:** Tuesday, October 08, 2013 10:55 AM  
**To:** Jonathan Connelly  
**Subject:** RE: Release of Purchase Order 258364

Please see below.

FedEx Accounts for Hawthorne:  
Small parcel and air freight account #: 251204527  
Main freight account #: 414707149

Thanks,

Duc Q. Phan  
SpaceX  
Process Engineer  
1 Rocket Road  
Hawthorne, CA 90250  
D PH: 31-363-6316  
C PH: 310-940-9320

**From:** Jonathan Connelly [<mailto:JConnelly@PVA.net>]  
**Sent:** Monday, October 07, 2013 8:15 AM  
**To:** Duc Phan  
**Subject:** RE: Release of Purchase Order 258364

Hi Duc,

Give me a call today when you get a chance? The status of your current order is dependent on what you want to with the 2<sup>nd</sup> material.

Thanks,

-Jon

**From:** Duc Phan [<mailto:Duc.Phan@spacex.com>]  
**Sent:** Wednesday, October 02, 2013 11:42 AM  
**To:** Jonathan Connelly  
**Subject:** RE: Release of Purchase Order 258364

Hello Jonathan,

I am waiting to talk with my manager but as for the original plan must stay on schedule for October 21 because I am reserve the from production that day.

I will call you this afternoon for sure.

Thanks

Duc Q. Phan  
SpaceX  
Process Engineer  
1 Rocket Road  
Hawthorne, CA 90250  
D PH: 31-363-6316  
C PH: 310-940-9320

**From:** Jonathan Connelly [<mailto:JConnelly@PVA.net>]  
**Sent:** Wednesday, October 02, 2013 8:39 AM  
**To:** Duc Phan  
**Subject:** RE: Release of Purchase Order 258364

Hi Duc,

I'm not sure where we left off with this.

Can you give me a call later this afternoon to discuss?

Thanks and best regards,

Jon Connelly  
Technical Sales  
PVA  
1 Mustang Drive  
Cohoes NY, 12047  
Ph# (518) 371-2684 ext 2421  
Cell (518) 487-9611  
Fax (518) 371-2688

**From:** Duc Phan [<mailto:Duc.Phan@spacex.com>]  
**Sent:** Thursday, September 26, 2013 3:02 PM  
**To:** Jonathan Connelly; warpdrive  
**Cc:** Rodrigo Gutierrez  
**Subject:** RE: Release of Purchase Order 258364

Hello Jonathan and Rod,  
We are interest in having second pneumatic valve adding to the existing changes.  
Please give me a call to go over the program and control.  
Thanks,

Duc Q. Phan  
SpaceX  
Process Engineer  
1 Rocket Road  
Hawthorne, CA 90250  
D PH: 31-363-6316  
C PH: 310-940-9320

**From:** Jonathan Connelly [<mailto:JConnelly@PVA.net>]  
**Sent:** Wednesday, September 25, 2013 8:50 AM  
**To:** Duc Phan; warpdrive  
**Cc:** Rodrigo Gutierrez  
**Subject:** RE: Release of Purchase Order 258364

Hi Duc,

Rod has you penciled in for a day of support on the week of the 21st.

You can work with Rod to get a specific day confirmed.

Best regards,

Jon Connelly  
Technical Sales  
PVA  
1 Mustang Drive  
Cohoes NY, 12047  
Ph# (518) 371-2684 ext 2421  
Cell (518) 487-9611  
Fax (518) 371-2688

**From:** Duc Phan [<mailto:Duc.Phan@spacex.com>]  
**Sent:** Wednesday, September 25, 2013 11:26 AM  
**To:** Jonathan Connelly; warpdrive  
**Subject:** RE: Release of Purchase Order 258364

Hello Jonathan,  
Per our conversation the sooner the better.  
On reserve Oct. 21-25 any one of these date will be fine.

Thanks,

Duc Q. Phan  
SpaceX  
Process Engineer  
1 Rocket Road  
Hawthorne, CA 90250  
D PH: 31-363-6316  
C PH: 310-940-9320

**From:** Jonathan Connelly [<mailto:JConnelly@PVA.net>]  
**Sent:** Wednesday, September 25, 2013 5:12 AM  
**To:** warpdrive  
**Cc:** Duc Phan  
**Subject:** RE: Release of Purchase Order 258364

Thanks Guys,

We will get started on this.

Duc,

Do you have a date that would be good for the on-site support to integrate this?

Best regards,

Jon Connelly  
Technical Sales  
PVA  
1 Mustang Drive  
Cohoes NY, 12047  
Ph# (518) 371-2684 ext 2421  
Cell (518) 487-9611  
Fax (518) 371-2688

**From:** Warp Drive [<mailto:warpdrive@spacex.com>]  
**Sent:** Tuesday, September 24, 2013 7:57 PM  
**To:** Jonathan Connelly  
**Cc:** [Duc.Phan@spacex.com](mailto:Duc.Phan@spacex.com)  
**Subject:** Release of Purchase Order 258364

Attached please find approved purchase order 258364. Please acknowledge receipt of Purchase Order by sending an email to Andrea Jarrett at [Andrea.Jarrett@spacex.com](mailto:Andrea.Jarrett@spacex.com). This message was automatically generated; Please contact the Buyer if the order requires any further clarification at the address mentioned above.

**Sent:** Monday, October 17, 2011 11:37 AM  
**To:** Ruben Juarez  
**Cc:** Andrew Lechuga  
**Subject:** RE: PVA-Conformal Coating machine---need your support---spec of the connector

Ruben,

Here are the specifications of the connector. Also please ask the PVA vendor to see what kind of underfill epoxy that can be used on the machine.

Thank you,

Dong N. Nguyen



3519 West Warner Avenue  
Santa Ana, CA 92704  
Telephone: 714.979.2228, ext. 134  
Fax: 714.556.0575  
Email: [dnguyen@eminc.com](mailto:dnguyen@eminc.com)  
Website: <http://www.eminc.com>

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---

**From:** Dong Nguyen  
**Sent:** Monday, October 17, 2011 10:56 AM  
**To:** Ruben Juarez  
**Cc:** Andrew Lechuga  
**Subject:** PVA-Conformal Coating machine---need your support  
**Importance:** High

Ruben,

Need some quick info from you:

- Can our PVA machines be used to underfill fine pitch SMT connectors about 3" wide?
- If our PVA machines can't perform the underfill in their existing stages, can we upgrade them to do so? The underfill process requires special underfill epoxy and the heat/temperature needs to be controlled accurately to ensure the epoxy's flow, etc., so what we need to upgrade on our PVA machines to make it work flawlessly?
- What underfill methods, types and dispensing patterns can the PVA machines do if at all?

This is urgent, so please talk to your PVA contacts to see if it's doable or not w/ our machines and let me know ASAP.

Thank you.

Dong N. Nguyen



3519 West Warner Avenue  
Santa Ana, CA 92704  
Telephone: 714.979.2228, ext. 134  
Fax: 714.556.0575  
Email: [dnguyen@eminc.com](mailto:dnguyen@eminc.com)  
Website: <http://www.eminc.com>

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**From:** Jonathan Urquhart  
**To:** Rodrigo Gutierrez  
**Subject:** Re: PVA-Conformal Coating machine---need your support---spec of the connector  
**Date:** Tuesday, October 18, 2011 10:40:17 AM  
**Attachments:** image002.gif  
image001.gif

---

Rod,

I'm sure we can do something for them as have the technology and are familiar with underfilling different types of components. Can they get us the material info?

I'll take a closer look tomorrow afternoon.

Jon

**From:** Rodrigo Gutierrez  
**Sent:** Monday, October 17, 2011 02:50 PM  
**To:** Jonathan Urquhart  
**Subject:** FW: PVA-Conformal Coating machine---need your support---spec of the connector

Jon,

Have we ever done underfill on a connector that is angled?. See attached.

Rod

**From:** Ruben Juarez [mailto:RJ Suarez@eminc.com]  
**Sent:** Monday, October 17, 2011 2:46 PM  
**To:** Rodrigo Gutierrez  
**Subject:** FW: PVA-Conformal Coating machine---need your support---spec of the connector

Hello Rodrigo,

Attach is more information on the project.

Regards.

Ruben Juarez  
Manufacturing Engineer



3519 West Warner Avenue  
Santa Ana, CA 92704  
714 247 9797- Cell  
714.979.2228, ext. 185  
714.556.0575 - Fax  
Website: <http://www.eminc.com>  
Celebrating nearly 30 years of experience in the EMS Industry!

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**From:** Dong Nguyen

Fw Arathane 5750 Spec  
From: restronicsbill@verizon.net  
Sent: Tuesday, March 13, 2012 3:21 PM  
To: Jonathan Urquhart  
CC: David Gomez  
Subject: Fw: Arathane 5750 Spec  
Attachments: 5750-Arathane\_5750AB-LV\_TDS.pdf

Hello John. I would like to talk to you about this material for conformal coating approved by NASA to help eliminate out gassing with parts going into space. I think David has spoken to you about our customer SpaceX. They build full blown rocket ships. They plan on pre-mixing this material part A part B and a 3rd part, thinner in small batches apply to board and the purge system because of shelf life once mixed. Sounds screwy to me. They first were looking at the 20th of this month but time is too short now so the 27th is next date to consider for demo. They will be send this material and boards soon. Do they send to your attention? Call me when you can. Thanks  
Bill Burns, Restronics So Cal, 310-634-7472 Sent from wireless BlackBerry

From: David Hwang <David.Hwang@spacex.com>  
Date: Tue, 13 Mar 2012 18:08:17 +0000  
To: restronicsbill@verizon.net<restronicsbill@verizon.net>  
Subject: Arathane 5750 Spec

David Hwang  
Avionics Materials & Process Engineer | Space Exploration Technologies  
1 Rocket Road | Hawthorne, CA 90250 | tel. 310.363.6400 x21267 |  
david.hwang@spacex.com

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FW Arathane 5750 Spec 2

From: Bill Burns [restronicsbill@verizon.net]  
Sent: Thursday, March 15, 2012 1:17 PM  
To: Jonathan Urquhart  
Cc: David Gomez  
Subject: FW: Arathane 5750 Spec  
Attachments: 5750-Arathane\_5750AB-LV\_TDS.PDF

Hello Jon, Below is an email I sent to SpaceX about upcoming visit to see a demo on 650. I also want them to learn all the capabilities PVA has.

Sending this because I want you both to know what was said. I did not tell them you were working on exact material just indicated it was similar. I have attached a copy of the product they will be sending to you.

Any questions or comments, let me know.  
Bill

Bill Burns  
REStronics  
27126A Paseo Espada, Suite 1602  
San Juan Capistrano, CA 92675  
cell: 310-634-7472; office 949-443-2211  
fax: 949-661-0990  
bburns@restronics.com

From: Bill Burns [mailto:restronicsbill@verizon.net]  
Sent: Thursday, March 15, 2012 10:12 AM  
To: 'David Hwang'; John Pena (John.Pena@spacex.com)  
Cc: Jose Bernabe (jose.bernabe@spacex.com)  
Subject: RE: Arathane 5750 Spec

Thanks David.

Hey John, not sure who will be going with you or if you will be going alone, but I spoke with Jon Urquhart of PVA and the 27th is still a viable date, but will be somewhat contingent on getting sample material. More boards are better, but two boards is also better than one.

I also learned PVA is currently doing some application work on a 3 part delivery system. I asked if this was a year away or a month away, and he came back with closer to a month as they are working on it right now. He knows the material and from the sounds of what he said it is similar material. If this is of interest, it will be possible to learn more about it when you visit PVA.

If SpaceX still plans on presenting the 650 with pre-mixed material, that is a non-issue. PVA point of view will consider it as a single material application.

Please send material and boards to:  
PVA  
One Mustang Drive  
Cohoes, NY 12047  
1-518-371-2684  
Attn: Jon Urquhart  
Senior Applications Eng

Page 1

FW Arathane 5750 Spec 2

Thanks,  
Bill

Bill Burns  
REStronics  
27126A Paseo Espada, Suite 1602  
San Juan Capistrano, CA 92675  
cell: 310-634-7472; office 949-443-2211  
fax: 949-661-0990  
bburns@restronics.com

From: David Hwang [mailto:David.Hwang@spacex.com]  
Sent: Tuesday, March 13, 2012 11:08 AM  
To: restronicsbill@verizon.net  
Subject: Arathane 5750 Spec

David Hwang  
Avionics Materials & Process Engineer | Space Exploration Technologies  
1 Rocket Road | Hawthorne, CA 90250 | tel. 310.363.6400 x21267 |  
david.hwang@spacex.com

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**From:** Jonathan Urquhart  
**To:** "restronicsbill@verizon.net"  
**Subject:** Re: Arathane 5750 Spec  
**Date:** Monday, March 19, 2012 1:06:54 PM

---

Hi Bill,

Yes, the 27th is good. Let me know if anything changes.

Thanks,  
Jon

Jon Urquhart  
Director - Global Applications Engineering  
PVA

---

**From:** restronicsbill@verizon.net [mailto:restronicsbill@verizon.net]  
**Sent:** Monday, March 19, 2012 03:31 PM  
**To:** Jonathan Urquhart  
**Subject:** Fw: Arathane 5750 Spec

Will this work out ok for the 27th? See below  
Bill Burns, Restrionics So Cal, 310-634-7472 Sent from Wireless BlackBerry

---

**From:** John Pena <John.Pena@spacex.com>  
**Date:** Mon, 19 Mar 2012 19:13:24 +0000  
**To:** Bill Burns<restronicsbill@verizon.net>  
**Cc:** Jose Bernabe<Jose.Bernabe@spacex.com>; David Hwang<David.Hwang@spacex.com>  
**Subject:** RE: Arathane 5750 Spec

Bill, the materials were dropped shipped Friday ground, should be there by the 27<sup>th</sup>, and I will 2<sup>nd</sup> day air the sample boards by tomorrow. Let me know if that will be enough time to set everything up.

Thanks

John Pena  
Avionics Clean Room Manager  
310-363-6992

---

**From:** Bill Burns [mailto:restronicsbill@verizon.net]  
**Sent:** Monday, March 19, 2012 11:47 AM  
**To:** John Pena  
**Cc:** Jose Bernabe; David Hwang  
**Subject:** RE: Arathane 5750 Spec

Hello John, just touching base to see if sample material and boards have been sent to PVA??

Let me know if the 27<sup>th</sup> still seems like a good date too.

Please send material and boards to:

PVA

One Mustang Drive

Cohoes, NY 12047

1-518-371-2684

Attn: Jon Urquhart

Senior Applications Eng

**Bill Burns**

**REStronics**

27126A Paseo Espada, Suite 1602

San Juan Capistrano, CA 92675

cell: 310-634-7472; office 949-443-2211

fax: 949-661-0990

bburns@restronics.com

**From:** Bill Burns [mailto:restronicsbill@verizon.net]

**Sent:** Thursday, March 15, 2012 10:12 AM

**To:** 'David Hwang'; John Pena (John.Pena@spacex.com)

**Cc:** Jose Bernabe (jose.bernabe@spacex.com)

**Subject:** RE: Arathane 5750 Spec

Thanks David.

Hey John, not sure who will be going with you or if you will be going alone, but I spoke with Jon Urquhart of PVA and the 27<sup>th</sup> is still a viable date, but will be somewhat contingent on getting sample material. More boards are better, but two boards is also better than one.

I also learned PVA is currently doing some application work on a 3 part delivery system. I asked if this was a year away or a month away, and he came back with closer to a month as they are working on it right now. He knows the material and from the sounds of what he said it is similar material. If this is of interest, it will be possible to learn more about it when you visit PVA.

If SpaceX still plans on presenting the 650 with pre-mixed material, that is a non-issue. PVA point of view will consider it as a single material application.

Please send material and boards to:

PVA

One Mustang Drive

Cohoes, NY 12047

1-518-371-2684

Attn: Jon Urquhart

Senior Applications Eng

Thanks,  
Bill

**Bill Burns**

**REStronics**

27126A Paseo Espada, Suite 1602  
San Juan Capistrano, CA 92675  
cell: 310-634-7472; office 949-443-2211  
fax: 949-661-0990  
bburns@restronics.com

---

**From:** David Hwang [mailto:David.Hwang@spacex.com]  
**Sent:** Tuesday, March 13, 2012 11:08 AM  
**To:** restronicsbill@verizon.net  
**Subject:** Arathane 5750 Spec

**David Hwang**

Avionics Materials & Process Engineer | Space Exploration Technologies  
1 Rocket Road | Hawthorne, CA 90250 | tel. 310.363.6400 x21267 | [david.hwang@spacex.com](mailto:david.hwang@spacex.com)

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**From:** Jonathan Urquhart  
**To:** "restronicsbill@verizon.net"  
**Subject:** RE: SpaceX NDA  
**Date:** Tuesday, March 20, 2012 2:00:11 PM

---

Bill,

Either our Operations Mgr or myself will send them back to Tony Figueroa.

Jon

**From:** restronicsbill@verizon.net [mailto:restronicsbill@verizon.net]  
**Sent:** Tuesday, March 20, 2012 4:59 PM  
**To:** Jonathan Urquhart  
**Subject:** Re: SpaceX NDA

That is good news. Will you be emailing them back? And do you know who they will be sent to at spacex?

Bill Burns, Restrionics So Cal, 310-634-7472 Sent from Wireless BlackBerry

---

**From:** Jonathan Urquhart <JUrquhart@PVA.net>  
**Date:** Tue, 20 Mar 2012 20:49:47 +0000  
**To:** 'Bill Burns' <restronicsbill@verizon.net>  
**Cc:** David Gomez <DGomez@PVA.net>  
**Subject:** RE: SpaceX NDA

Bill,

We already got these documents to sign. If they don't get back today, they will be returned tomorrow morning.

Thanks,  
Jon

**From:** Bill Burns [mailto:restronicsbill@verizon.net]  
**Sent:** Tuesday, March 20, 2012 4:34 PM  
**To:** Jonathan Urquhart  
**Cc:** David Gomez  
**Subject:** FW: SpaceX NDA

Jon, will you please get these signed and emailed back as soon as possible. SpaceX needs these before they can send boards. Sorry for this coming at you late.

Thanks,  
Bill

**Bill Burns**  
**REStronics**  
27126A Paseo Espada, Suite 1602

San Juan Capistrano, CA 92675  
cell: 310-634-7472; office 949-443-2211  
fax: 949-661-0990  
[bburns@restronics.com](mailto:bburns@restronics.com)

---

**From:** Antonio Figueroa [<mailto:Antonio.Figueroa@spacex.com>]  
**Sent:** Thursday, February 23, 2012 3:24 PM  
**To:** Jose Bernabe; Bill Burns ([restronicsbill@verizon.net](mailto:restronicsbill@verizon.net))  
**Subject:** RE: SpaceX NDA

Bill,  
Please see attached NDA and ITAR.

Thanks  
Tony

---

**From:** Jose Bernabe  
**Sent:** Thursday, February 23, 2012 1:33 PM  
**To:** Bill Burns ([restronicsbill@verizon.net](mailto:restronicsbill@verizon.net))  
**Cc:** Antonio Figueroa  
**Subject:** SpaceX NDA

Bill,  
  
I need your help getting a NDA signed by Scienscope before a can show our PCBA at the Expo.

Tony,

Please forward Bill our NDA form.

Thanks  
Jose

Fw PVA Test Demonstration Trials

From: restronicsbill@verizon.net  
Sent: Thursday, March 22, 2012 8:19 PM  
To: Jonathan Urquhart  
Cc: David Gomez  
Subject: Fw: PVA Test Demonstration Trials

Hi Jon let me know your thoughts and if there is still time to get this done on the 27th. I told them yesterday we were still a go for that day. Now with these desires not sure. They are very interested in your efforts to three part mix in line rather than mix a small batch and purge their life away. They do understand they may have to do it that way but are excited to have a more automated method  
Bill Burns, Restrionics So Cal, 310-634-7472 Sent from Wireless BlackBerry

From: John Pena <John.Pena@spacex.com>  
Date: Fri, 23 Mar 2012 00:02:31 +0000  
To: Bill Burns<restronicsbill@verizon.net>  
Subject: PVA Test Demonstration Trials

Bill please forward to PVA our desired test witness plan

Planned Test Demonstration to include witnessing of the following

- Mixing materials to correct ratio and viscosity
- Setting up of the materials and machine
- Programming of machine to apply material with selective coating for keep out areas to mitigate masking
- Examination of any over spray in keep out areas
- Examination of coated boards and process to NASA 8739.1 standards 10.2 - 10.5
- Verify thickness (.0003 +/- .0001) of coating application with aluminum coupons
- A hardness coupon (aluminum weighing dish with at least 0.25" of material)
- PVA's recommendations on how often to purge the machine and scheduled maintenance
- Purging of the machine valves, nozzles, canisters and lines

Forwarded to PVA were

- PWB unpopulated for set up trials
- PCBA populated for set up trials
- PCBA populated for Test Demonstration
- Arathane 5750 kit

Thanks,

John Pena  
Avionics Clean Room Manager  
310-363-6992

Fw PVA Test Demonstration Trials 2

From: restronicsbill@verizon.net  
Sent: Friday, March 23, 2012 12:08 PM  
To: Jonathan Urquhart  
Cc: David Gomez  
Subject: Fw: PVA Test Demonstration Trials

See spaceX reply to my email below  
Bill Burns, Restrionics So Cal, 310-634-7472 Sent from wireless BlackBerry

-----Original Message-----

From: John Pena <John.Pena@spacex.com>  
Date: Fri, 23 Mar 2012 15:59:29  
To: <restronicsbill@verizon.net><restronicsbill@verizon.net>  
Subject: Re: PVA Test Demonstration Trials

Bill, thanks for the email, I wasn't wholly counting on the automated mixing system but would of liked to have seen both processes. I am ok with a demonstration involving the premixing of the materials to see how involved the process is from start to finish with the purging of the system.

We have some time before making our final selection process and anticipate delivery will be required some time in Q3.

As far as the Arathane materials they are new to us and we have not tried them yet and was hoping to learn from this trip the process to bring back to try out on our 350 machine or learn if any modifications would be required, wouldn't anticipate any but you never know.

As far as the meter mixing of a three part system dispersed at the nozzle I would be interested to hear about what is planned or being proposed and what would be the delta equipment and cost necessary to go from a premixing to a auto mix spray system.

Thanks  
John Pena

Sent from my iPad

On Mar 23, 2012, at 8:18 AM,  
"restronicsbill@verizon.net<mailto:restronicsbill@verizon.net>"  
<restronicsbill@verizon.net<mailto:restronicsbill@verizon.net>> wrote:

Morning John. I just want to clarify what you will not see. We cannot demonstrate a fully automated mixing system for the 3 part process yet nor can we even put together a test while you are there. We can show equipment with mixing capability for 2 part materials but 3 part is such a special application that there is nothing available to run this process yet. We are looking into it but there will be much testing required. As I said, presenting pre-mixed material to the machine, is doable because it will be as if it is a single material.

If SpaceX is putting a lot of weight on the automated mix process, then it will be best to postpone the visit until we have some testing completed. As I mentioned we are planning on testing the 3 part system soon but this will not something we will show potential customers until we get it down.

Right now it is a "science project", and as I am sure SpaceX understands, we will not launch until we have the confidence of a high probability of success.

I have a few questions; have you guys mixed any of this material yet yourselves? Have you tried to coat boards in any fashion once you have mixed it? And if so what test results did you get?

Bill Burns, Restrionics So Cal, 310-634-7472 Sent from wireless BlackBerry  
Page 1

Fw PVA Test Demonstration Trials 2

From: John Pena <John.Pena@spacex.com<mailto:John.Pena@spacex.com>>  
Date: Fri, 23 Mar 2012 00:02:31 +0000  
To: Bill Burns<restronicsbill@verizon.net<mailto:restronicsbill@verizon.net>>  
Subject: PVA Test Demonstration Trials

Bill please forward to PVA our desired test witness plan

Planned Test Demonstration to include witnessing of the following

- Mixing materials to correct ratio and viscosity
- Setting up of the materials and machine
- Programming of machine to apply material with selective coating for keep out areas to mitigate masking
- Examination of any over spray in keep out areas
- Examination of coated boards and process to NASA 8739.1 standards 10.2 - 10.5
- Verify thickness (.0003 +/- .0001) of coating application with aluminum coupons
- A hardness coupon (aluminum weighing dish with at least 0.25" of material)
- PVA's recommendations on how often to purge the machine and scheduled maintenance
- Purging of the machine valves, nozzles, canisters and lines

Forwarded to PVA were

- PWB unpopulated for set up trials
- PCBA populated for set up trials
- PCBA populated for Test Demonstration
- Arathane 5750 kit

Thanks,

John Pena  
Avionics Clean Room Manager  
310-363-6992

---

**From:** Bill Burns [mailto:restronicsbill@verizon.net]  
**Sent:** Wednesday, March 28, 2012 6:06 PM  
**To:** Jonathan Urquhart  
**Subject:** SpaceX

Hi Jon. You should have parts and material as of today. Let me know if the dates below will work for you and how your testing on 3 part is going

Bill Burns  
Restronics Southern California  
Cell 310-634-7472  
Office 949-443-2211  
Sent from my iPad

Begin forwarded message:

**From:** John Pena <[John.Pena@spacex.com](mailto:John.Pena@spacex.com)>  
**Date:** March 28, 2012 2:21:52 PM PDT  
**To:** "<[restronicsbill@verizon.net](mailto:restronicsbill@verizon.net)>" <[restronicsbill@verizon.net](mailto:restronicsbill@verizon.net)>  
**Subject:** Re: Pva Visit

Bill how about the following week the 10th or 11th?

John Pena

Sent from my iPad

On Mar 27, 2012, at 1:13 PM, "<[restronicsbill@verizon.net](mailto:restronicsbill@verizon.net)>"  
<[restronicsbill@verizon.net](mailto:restronicsbill@verizon.net)> wrote:

Hi John any word on eta of samples? Next available date would be April 5th or 6th and I assume samples will be there. Let me know your thoughts

Bill Burns, Restronics So Cal, 310-634-7472 Sent from  
Wireless BlackBerry

**From:** [Jonathan Urquhart](#)  
**To:** ["restronicsbill@verizon.net"](mailto:restronicsbill@verizon.net)  
**Subject:** Re: New scheduled SpaceX Visit  
**Date:** Friday, March 30, 2012 1:34:16 PM

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Sounds good. I'll put it in the calendar.

Thanks,  
Jon

Jon Urquhart  
Director - Global Applications Engineering  
PVA

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**From:** Bill Burns [<mailto:restronicsbill@verizon.net>]  
**Sent:** Friday, March 30, 2012 04:27 PM  
**To:** Jonathan Urquhart  
**Subject:** RE: New scheduled SpaceX Visit

SpaceX will be there on 4-11-12

Please let me know this will still be a good date.  
Thanks,  
Bill

**Bill Burns**  
**REStronics**  
27126A Paseo Espada, Suite 1602  
San Juan Capistrano, CA 92675  
cell: 310-634-7472; office 949-443-2211  
fax: 949-661-0990  
[bburns@restronics.com](mailto:bburns@restronics.com)

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**From:** Jonathan Urquhart [<mailto:JUrquhart@PVA.net>]  
**Sent:** Thursday, March 29, 2012 5:18 AM  
**To:** 'Bill Burns'  
**Subject:** RE: SpaceX

Hi Bill,

Yes, we got the material a few days ago and got the boards yesterday. The 11<sup>th</sup> would work best for their visit. Please confirm when you can.

We have the test unit setup and hope to have a good idea of capability by mid next week.

Thanks,  
Jon



**From:** [Jonathan Urquhart](#)  
**To:** [David Gomez](#)  
**Cc:** [Bill Burns](#)  
**Subject:** RE: PVA Contact  
**Date:** Friday, May 11, 2012 11:14:43 AM

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Hi David,

Yes, I spoke to David Hwang a few days ago and we talked about having the below items on their machine to be able to duplicate what we did during their visit to PVA.

Jon

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**From:** David Gomez  
**Sent:** Friday, May 11, 2012 2:11 PM  
**To:** Jonathan Urquhart  
**Cc:** Bill Burns  
**Subject:** FW: PVA Contact

Hi Jon,

Has anyone from Space X CA talked to you about a possible retrofit on their existing PVA350?..

They have provided us with the below list of items they want us to integrate to the machine and I wanted to confirm this is something we recommended or this is something they came up with themselves.

Thanks

David E Gomez  
Regional Sales  
281 217 7247

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**From:** [restronicsbill@verizon.net](mailto:restronicsbill@verizon.net) [<mailto:restronicsbill@verizon.net>]  
**Sent:** Friday, May 11, 2012 12:02 PM  
**To:** David Gomez  
**Subject:** Fw: PVA Contact

Need your help with quote. Would also like to discuss. Call when you can.  
Bill Burns, Restrionics So Cal, 310-634-7472 Sent from Wireless BlackBerry

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**From:** David Hwang <[David.Hwang@spacex.com](mailto:David.Hwang@spacex.com)>  
**Date:** Thu, 10 May 2012 23:22:20 +0000  
**To:** [restronicsbill@verizon.net](mailto:restronicsbill@verizon.net) <[restronicsbill@verizon.net](mailto:restronicsbill@verizon.net)>  
**Cc:** Jose Bernabe <[Jose.Bernabe@spacex.com](mailto:Jose.Bernabe@spacex.com)>  
**Subject:** RE: PVA Contact

Hi Bill,

Can you get me prices on the following for upgrading our PVA350 setup:

1. FC100-MC needle dispense valve.
2. 6 oz cartridges for the reservoir
3. 12 oz cartridges for the reservoir
4. Two reservoir systems
5. Solvent tank for purge cleaning
6. Switching valve to switch to the solvent tank
7. 4<sup>th</sup> axis servo (I know this is **NOT** a field install, but just a rough estimate)

We can discuss this in person or over the phone tomorrow. Let me know if you have time.

Thanks,

**David Hwang**

Avionics Materials & Process Engineer | Space Exploration Technologies  
1 Rocket Road | Hawthorne, CA 90250 | tel. 310.363.6400 x21267 | [david.hwang@spacex.com](mailto:david.hwang@spacex.com)

*\* This Email Contains Sensitive Proprietary and Confidential Information - Not for Further Distribution Without the Express Written Consent of Space Exploration Technologies*

**From:** [restronicsbill@verizon.net](mailto:restronicsbill@verizon.net) [<mailto:restronicsbill@verizon.net>]  
**Sent:** Wednesday, May 09, 2012 9:20 AM  
**To:** David Hwang  
**Subject:** Re: PVA Contact

Might consider adding a 4th axis upgrade too.  
Bill Burns, Restronics So Cal, 310-634-7472 Sent from Wireless BlackBerry

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**From:** David Hwang <[David.Hwang@spacex.com](mailto:David.Hwang@spacex.com)>  
**Date:** Wed, 09 May 2012 15:55:28 +0000  
**To:** [restronicsbill@verizon.net](mailto:restronicsbill@verizon.net) <[restronicsbill@verizon.net](mailto:restronicsbill@verizon.net)>  
**Subject:** RE: PVA Contact

Thanks!

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**From:** [restronicsbill@verizon.net](mailto:restronicsbill@verizon.net) [<mailto:restronicsbill@verizon.net>]  
**Sent:** Wednesday, May 09, 2012 8:55 AM  
**To:** David Hwang  
**Cc:** Jon Urquhart  
**Subject:** Re: PVA Contact

I would start with contacting Jon Urquhart 518-371-2684. He is the person that did demo for the guys that went back to PVA and is senior in applications. I have cc'ed Jon so you will also have his email address.

Bill Burns, Restronics So Cal, 310-634-7472 Sent from Wireless BlackBerry

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**From:** David Hwang <[David.Hwang@spacex.com](mailto:David.Hwang@spacex.com)>  
**Date:** Wed, 09 May 2012 15:43:52 +0000  
**To:** [restronicsbill@verizon.net](mailto:restronicsbill@verizon.net) <[restronicsbill@verizon.net](mailto:restronicsbill@verizon.net)>

**Subject:** PVA Contact

Bill,

As part of our current conformal coating system downselect, I think we'll be picking up the needed valves and dispense/spray heads to better utilize our PVA 350. Do you have a contact I can talk to for some guidance on valves?

Thanks,

**David Hwang**

Avionics Materials & Process Engineer | Space Exploration Technologies

1 Rocket Road | Hawthorne, CA 90250 | tel. 310.363.6400 x21267 | [david.hwang@spacex.com](mailto:david.hwang@spacex.com)

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PVA 4537

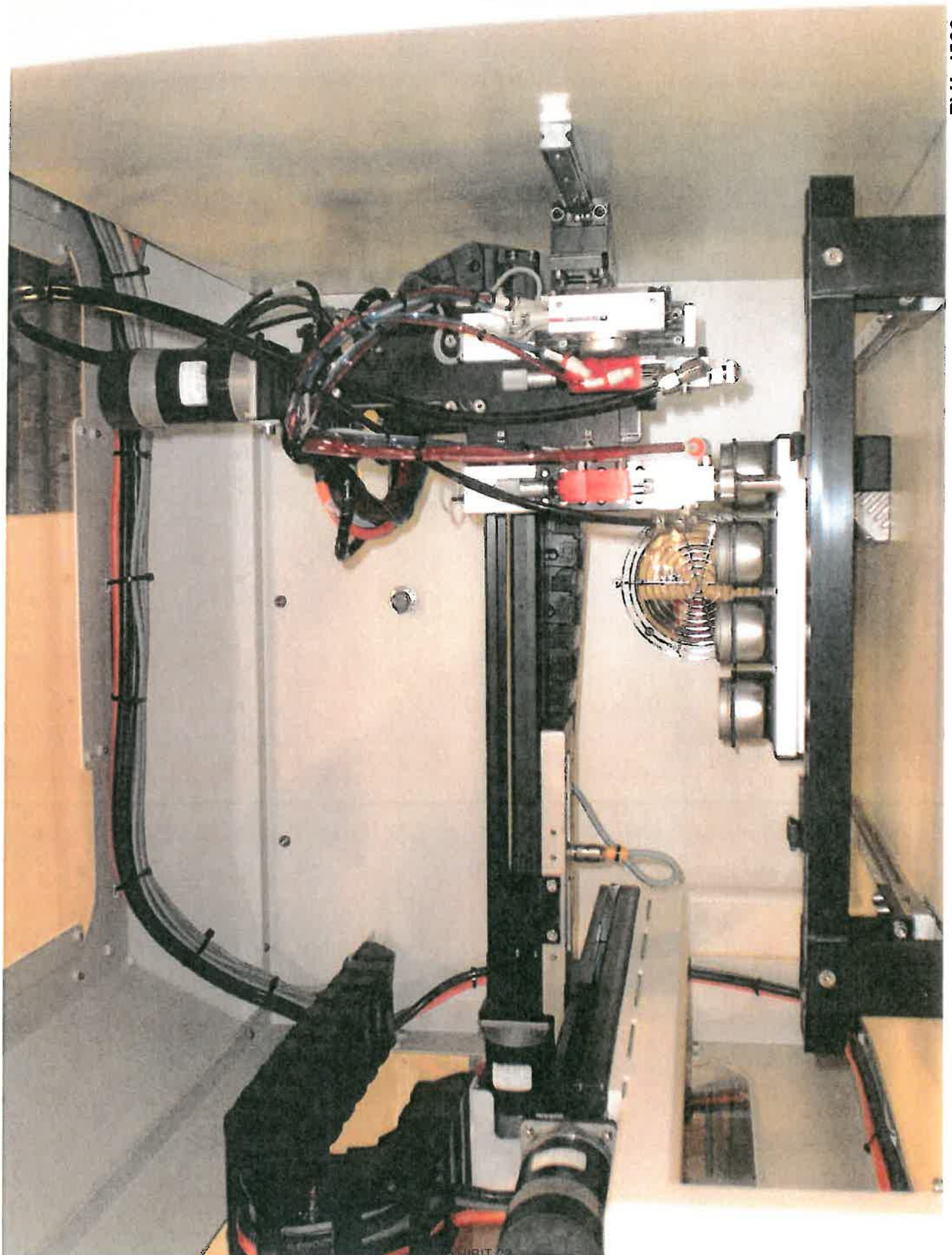
EXHIBIT 22





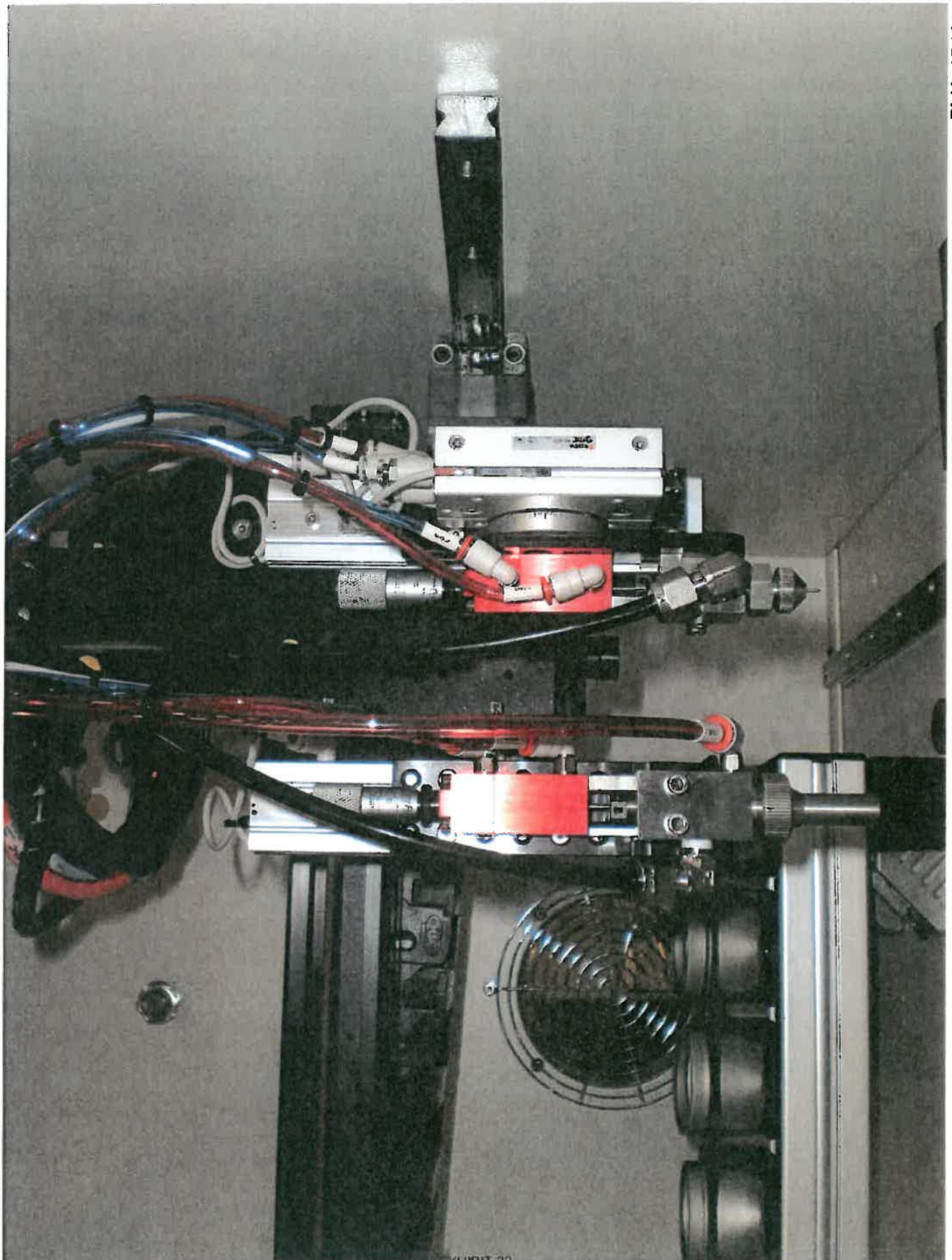
PVA 4538

EXHIBIT 22



PVA 4539

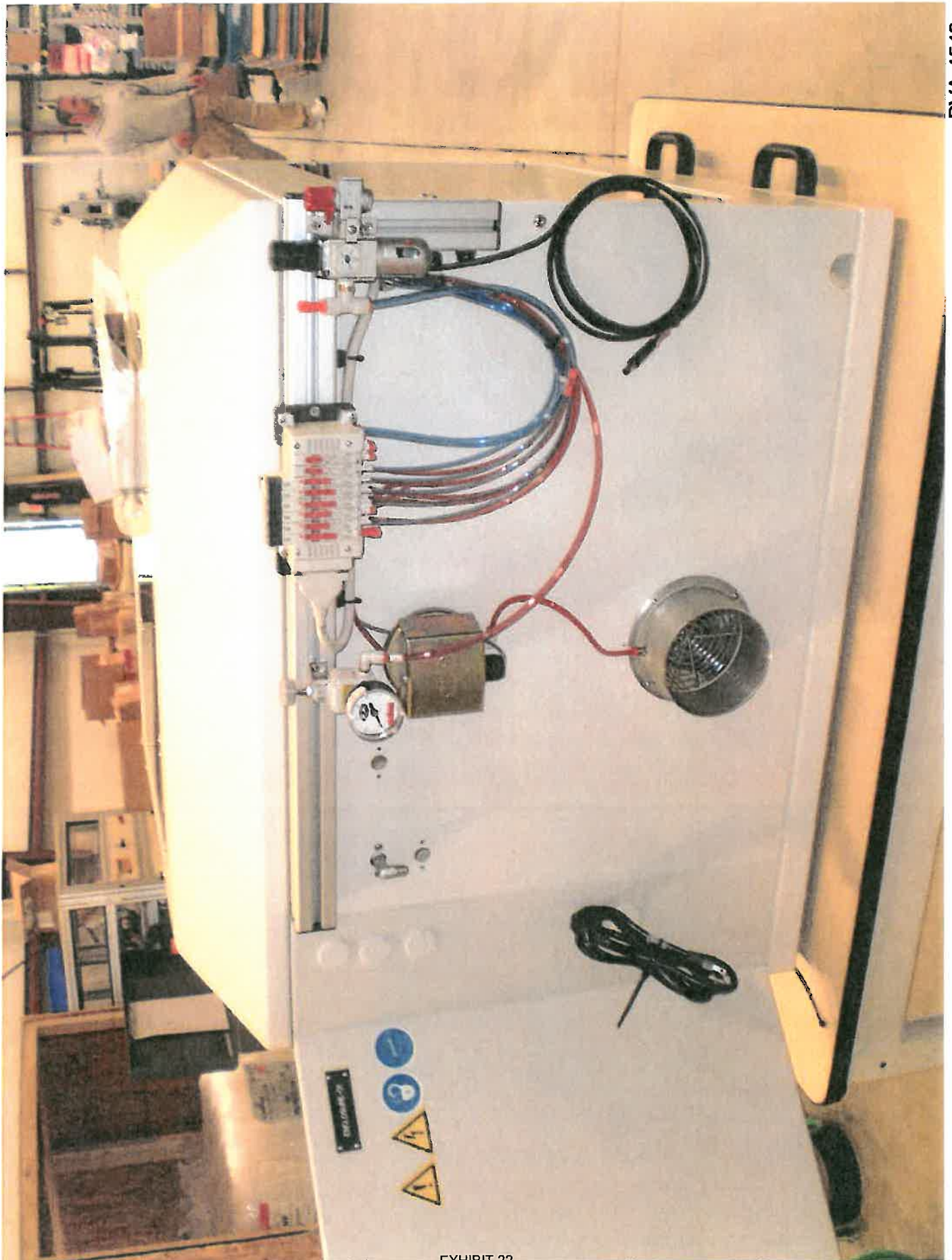




PVA 4540

EXHIBIT 22





PVA 4542

EXHIBIT 22